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HARTLEY (C.). **A decade of research in forest pathology.**—*J. For.*, xxxvi, 9, pp. 908–912, 1938.

This is a survey of some outstanding researches in the field of silvicultural pathology during the past ten years in the United States.

LIUBARSKY (V. L.). Дереворазрушающие грибы Березы Шмидта. **(Betula schmidtii Rgl)** [Wood-destroying fungi of the Schmidt Birch (*Betula schmidtii* Rgl).]—*Bull. Far Eastern Br. Acad. Sci. U.S.S.R.* 29 (2), pp. 113–118, 1938.

The author records 39 fungi attacking *Betula schmidtii*, growing in the basin of the Mongougai river in the Far Eastern region of the U.S.S.R. mainly in association with oak. The chief parasite, causing most serious damage, was *Polyporus sulphureus* [*R.A.M.*, xviii, p. 4].

CAMPBELL (W. A.) & DAVIDSON (R. W.). **A Poria as the fruiting stage of the fungus causing the sterile conks on Birch.**—*Mycologia*, xxx, 5, pp. 553–560, 3 figs., 1938.

In August, 1937, a brown *Poria* was collected on a limb of a decayed, standing yellow birch (*Betula lutea*) in the October Mountains State Forest, Massachusetts, and extensive search in the area showed it to be commonly present on dead, standing, decayed yellow and white birch (*B. populifolia*) trunks, but only on those bearing sterile conks. Sporophore and spore isolations from the *Poria* yielded a fungus identical with that obtained from the conks and the decay associated with them, demonstrating that the *Poria* was the fruiting stage of the fungus causing the conks [cf. *R.A.M.*, viii, p. 345].

Infection appears to take place through trunk and top wounds, branch stubs, and old, open *Nectria* cankers. The *Poria* produces a well-defined heart rot which spreads up and down the trunk, but is prevented by the sapwood from any extensive radial spread. In time, a sterile conk, consisting of brown, short-celled, parallel hyphae, which appear as pseudoparenchyma cells in cross-section, develops, presumably at the point of entry, and frequently at other places on the trunk where the *Poria* penetrates the sapwood. The conks appear to enlarge year by year, sometimes attaining a diameter of over 1 ft. At first they are yellowish-brown, but soon turn into a dark, cracked, clinker-like mass. The tree weakens and often breaks, usually where a conk has formed. After the death of the tree the conk ceases to enlarge.

The fungus in the trunk grows out through the dead sapwood, and in two or three years forms a thin, dark brown layer of the same type of hyphal cells as are found in the sterile conk; this layer develops into the brown *Poria*. By the time the fungus has split the bark and is able to shed spores, the decay is well advanced and the conks are often so badly weathered as to be almost unrecognizable. Insects attack the sporophore as soon as it breaks through the bark and rapidly cause it to disintegrate. Fruiting appears to take place chiefly in the early summer, but may last until October.

The fungus would seem to belong to the *P. obliqua* complex and to be probably identical with the fungus resembling *P. obliqua* on birches in Sweden and the U.S.S.R. Unlike Skoric's fungus, however, found on oak in Europe [ibid., xvi, p. 506], it fruits under the bark and thin wood layer of dead trees, does not possess readily demonstrable setal hyphae in the trama, and in culture forms setal hyphae seldom exceeding 8 μ in diameter.

POMERLEAU (R.). **Recherches sur le Gnomonia ulmea (Schw.) Thüm.** [Studies on *Gnomonia ulmea* (Schw.) Thüm.]—*Nat. canad.*, lxiv, 11, pp. 261–289; 12, pp. 297–318, 1937; lxv, 1, pp. 23–41; 2, pp. 57–70; 3, pp. 89–97; 4, pp. 125–137; 5, pp. 167–188; 8–9, pp. 221–237; 10, pp. 253–279, 22 pl., 1 fig., 2 diags., 8 graphs, 1938.

The author has made an exhaustive study of the life-history of *Gnomonia ulmea* on elms [*R.A.M.*, xviii, p. 11] in Quebec, and presents a fully documented and tabulated account of his researches, dealing primarily with the bio-ecological and histo-cytological aspects of the subject.

The distribution of the fungus in Canada and the United States is co-extensive with that of its principal host, *Ulmus americana*; it is also occasionally observed on *U. fulva* and *U. racemosa*, while according to L. E. Miles (*Bot. Gaz.*, lxxi, p. 161, 1921), it may further be found on *U. alata*, *U. crassifolia*, and possibly *U. serotina*. *G. ulmea* is a strictly obligatory parasite, developing exclusively on the tender, living tissues of its hosts. Its life-cycle terminates in the autumn, shortly after the death and fall of the leaves, with the formation of ascospores, which attain maturity under local conditions at the beginning of December. Next spring (May) ascospores are ejected for a distance of 3 to 4 mm. from the perithecia on the dead foliage under a particular combination of weather conditions comprising a temperature of at least 45° F. for several days and an alternation of wet and dry periods. The discharge of the ascospores generally synchronizes almost exactly with the inception of new growth on the host, which is readily invaded. The ascospores germinate immediately in a saturated atmosphere; they are enveloped by a brownish secretion which presumably assists in the penetration of the cuticle, no appressoria having been detected. The mycelium may invade the entire mesophyll. In young leaves the resultant lesions may reach a considerable size, but they are usually limited in adult foliage. The mycelium is intercellular and forms a black subcuticular stroma, constituting the base of the acervulus. The conidia are detached and disseminated, after the rupture of the cuticle, exclusively under the action of rain; they serve to perpetuate the disease

throughout the summer at an intensity varying with weather conditions, especially humidity, an abundance of which is essential for each fresh crop of foliar infections. In the districts under observation the formation of the sexual phase of *G. ulmea* does not begin until the end of June. The cytological processes of the elm pathogen are fully described and discussed.

With regard to control, the author states that in a local planting of young elms (under six years) satisfactory results have been secured with two applications of 4–4–40 Bordeaux mixture, one before the leaves are fully expanded and the other towards the end of July.

Swingle (R. U.). **A phloem necrosis of Elm.**—*Phytopathology*, xxviii, 10, pp. 757–759, 1938.

A virulent phloem necrosis of American elms [*Ulmus americana*], first observed in Ohio in 1918, was responsible at Chillicothe during 1936–7 for the death of a thousand trees, or half the city's elms. The first symptoms, which ultimately involve the whole crown, appear at the outer tips of the topmost branches, where the foliage becomes thin, the leaves droop because of the downward curvature of the petioles, and the leaf blades turn up at the margin, producing a trough-like effect, often accompanied by stiffness and brittleness. Subsequently the leaves turn yellow and fall. At a more advanced stage of infection the root phloem and cambium become discoloured prior to death, and frequently the discoloration extends into the trunk and branches. The cambium first turns light yellow or golden and the adjacent phloem yellow, later brown, with small, scattered, black flecks, and finally dark brown and necrotic. Moderately discoloured phloem emits a characteristic odour of wintergreen. No organism has been consistently isolated from the infected tissues or observed in association with them, and the only means of transmitting the disorder from affected to healthy trees was by grafting patches of diseased bark, root scions, or branch scions from the former on to the latter, which led to the complete transference of symptoms in 14 out of 21, 5 out of 26, and 13 out of 20 cases, respectively. The phloem necrosis would appear to be of a systemic character and due to a virus.

Davidson (R. W.) & Lorenz (R. C.). **Species of Eutypella and Schizoxylon associated with cankers of Maple.**—*Phytopathology*, xxviii, 10, pp. 733–745, 5 figs., 1938.

Latin and English diagnoses are given of *Eutypella* (*Eutypa*) *parasitica* n.sp. and *Schizoxylon microsporum* n.sp., found producing cankers on sugar and red maples (*Acer saccharum* and *A. rubrum*) in the Lake States in 1935.

The *Eutypella* cankers are characterized by firmly attached bark, with underlying marginal, heavy, white to buff mycelial fans, slightly raised concentric rings of callus, and long-beaked, black, subglobose perithecia, 0·6 to 0·9 mm. in diameter, with black, sulcate ostioles, irregularly crowded together in groups of 10 to 40 or more in the centres of old overgrowths. The average annual extension of the cankers, about ½ in., is occasionally interrupted, imparting an irregular appearance to the excrescences and leading to considerable stem distortion

in older trees. The fungus penetrates deeply into the sapwood below the canker and also grows slowly upwards and downwards, forming a central column of discoloured wood. Infection appears to occur when the trees are young and may continue for many years. The cankers are usually formed at a height of 2 to 8 ft. from the ground, but have occasionally been observed both at soil-level and 30 ft. above it. Usually there is only one on a tree. The fungus often kills young trees but seems at present to be of importance only in stands containing a high proportion of sugar maple. Inoculation experiments carried out in 1936 failed to yield conclusive evidence of parasitism. *E. parasitica* is further characterized by stipitate asci, the spore-bearing portion measuring 32 to 40 by 6 to 7 μ and the stipe 10 to 40 by 1·5 μ, containing eight irregularly bi- or pluriseriate, slightly curved, dark brown ascospores, 8 to 11 by 2 to 2·3 μ, and curved, hyaline to pale buff, cylindrical conidia, tapering at both ends, 26 to 34 by 1 μ (found in culture only). Good growth was made at 20° to 35° C., little or none at 40°.

The damage caused by *S. microsporum* appears to be insignificant, the cankers being rare and usually occurring on suppressed trees less than 3 in. in diameter. The cankers are smaller and more sunken than those of the *Eutypella* type and the marginal, white mycelial fans are relatively inconspicuous. The irregular extension of the overgrowths is accompanied by distortion of the trunks, at first manifested by a flattening and later by a protruding margin of thickened callus tissue. The pale grey, globose pycnidia of *S. microsporum*, 0·6 to 1 mm. in diameter, are commonly to be found imbedded in the exposed wood or in the bark near the margin of the canker, occasionally accompanied by flask- or cup-shaped apothecia, 0·7 to 1 mm. in diameter. The cylindrical, short-stalked asci measure 170 to 200 by 8 to 12 μ, the filiform, simple, pluriseptate paraphyses 1·3 to 1·7 μ in diameter, and the filiform, pluriseptate ascospores 1 μ or less in diameter, subsequently breaking up into short rods or slightly curved segments, usually 2 to 3 by 1 μ, sometimes 4 to 8 by 1 μ. *S. microsporum* grew well on 2·5 per cent. malt agar at 15° to 30°.

FOWLER (M. E.). **Twig cankers of Asiatic Chestnuts in the eastern United States.**—*Phytopathology*, xxviii, 10, pp. 693–704, 1 fig., 1938.

Of the various fungi isolated from dying Chinese and Japanese chestnuts (*Castanea mollissima* and *C. crenata*) on poor sites in different parts of the eastern United States, three, namely, *Cryptodiaporthe castanea* [*R.A.M.*, xvi, p. 845], *Botryosphaeria ribis* [var.] *chromogena* [ibid., xvii, p. 755], and *Diplodia* sp. [ibid., xvii, p. 355] were shown by inoculation experiments to be capable of invading the living tissue and producing twig cankers and die-backs. *D.* sp. is characterized by black, globoid, erumpent pycnidia, usually produced in groups in a stroma in the outer cortical layer. The ovoid to elliptical conidia, 18 to 26 by 11·5 to 16 μ, are subhyaline and non-septate at first, frequently becoming dark and uniseptate at maturity.

C. castanea, the fungus most commonly associated with chestnut cankers, has been found in 18 States and the District of Columbia, and is thought to have been present for some time in 30- to 40-year-old groves, though possibly of European origin. It may cause damage in

nurseries and among planted trees, frequently killing individual branches and thus decreasing growth and inducing deformation. The other two organisms under observation have only been collected a few times and are not yet known to be of much importance.

SMITH (C. O.). **Inoculation on conifers with the Cypress Coryneum.**—*Phytopathology*, xxviii, 10, pp. 760–762, 1938.

A planting of *Cupressus macrocarpa* at the Citrus Experiment Station, Riverside, California, is stated to have been reduced by *Coryneum cardinale* [*R.A.M.*, xvii, p. 715] to a few trees, which are now severely infected, while adjacent stands of *Cupressus sempervirens* and *C. glauca* have apparently escaped. Positive results were given by inoculation experiments involving the insertion of mycelium from pure cultures of the fungus or disks from spore-bearing lesions through wounds on *C. arizonica, C. bakeri, C. duttoni, C. forbesi, C. glabra, C. goveniana, C. guadalupensis, C. lusitanica, C. macnabiana, C. macrocarpa, C. pygmaea, C. sargenti, C. sempervirens, C. thurifera, Thuja plicata, T. orientalis, T. occidentalis, Juniperus cedrus, J. californica, J. virginiana,* and *Libocedrus decurrens*. Some of the *Cupressus* stems were partially or entirely girdled by the cankers after 3½ months, while on the other trees used in the tests the spread of the fungus was less rapid.

PIERSON (R. K.) & BUCHANAN (T. S.). **Age of susceptibility of Ribes petiolare leaves to infection by aeciospores and urediospores of Cronartium ribicola.**—*Phytopathology*, xxviii, 10, pp. 709–715, 1938.

A tabulated account is given of experiments in which *Ribes petiolare* leaves of 18 age classes from 1 to 72 days were inoculated with aqueous suspensions of the aecidiospores and uredospores of *Cronartium ribicola* [*R.A.M.*, xviii, p. 72]. Infection occurred at all ages, but was most severe in the case of both spore types on young foliage (up to three weeks after emergence from the buds) and gradually decreased after the leaves reached their mature size.

ZOGG (H.). **Bispora nigra, ein neuer holzverfärbender Pilz.** [*Bispora nigra*, a new wood-staining fungus.]—*Ber. schweiz. bot. Ges.*, xlviii, pp. 5–8, 1 fig., 2 graphs, 1938.

Latin and German diagnoses are given of *Bispora nigra* n.sp., a saprophyte isolated in pure culture on malt agar from a partially decayed and blue-stained spruce (*Picea excelsa*) [*P. abies*] telegraph pole in the canton of Berne in 1937. The fungus, which made profuse growth at a temperature of 23° to 24° C., with a minimum above 3°, is characterized by intensely black, smooth, semi-lustrous, spreading colonies, consisting of fuliginous, septate, branched, repent hyphae, 2 μ in diameter; the hyaline, later opaquely granular conidia, 10·5 to 20 by 6·5 to 10 μ, are non- to bi-, generally uniseptate and arise either in branched chains, as a result of the disintegration of the hyphae, or singly from short lateral branches. The shape of the concatenate conidia varies according to their position in the chain, those at the ends being ovoid to globular while the middle ones are commonly fusiform and truncated at both ends.

HUNT (G. M.). **Treating wood for protection and service.**—*J. For.*, xxxvi, 9, pp. 885–888, 1938.

This is a general review of the progress made during the last ten years in the development of wood preservatives (against insect and fungal decay and fire) in the United States.

HADERT (H.). **Uebersicht über die bekanntesten Holzschutzmittel.** [Survey of the best-known wood preservatives.]—*Farben-Chem.*, ix, 9, pp. 296–300, 1938.

This is a useful summary, incorporating the latest available information, of up-to-date methods of timber preservation and their practical applications in modern life in Germany and elsewhere.

LACKEY (C. F.). **Curly-top virus in root tips of Sugar Beets and Beans.**—Abs. in *Phytopathology*, xxviii, 9, p. 671, 1938.

The translocation of the curly top virus has been found to take place through the phloem of its hosts, while studies on the root tips of sugar beets [see next abstract] and beans [*Phaseolus vulgaris*: *R.A.M.*, xvii, p. 646] further revealed the presence of the virus below the protophloem sieve-tubes in the meristematic region. Tests for the virus in sections of fresh root tips from 0·2 to 0·5 mm. in length disclosed a much higher percentage of infection in the tissues below the protophloem sieve-tubes of susceptible beets than in sections including this region or in entire rootlets 5 mm. long. When four sections were cut from tips, each 0·5 mm. in length, twice as much infection was produced with virus from the third as from the second section but less than from that of the root cap. Similar results were obtained from diseased bean root tips, although there was less difference between the percentages of infection in the three lots of tissue. Degeneration of the pericycle of the root tips closely follows the sieve-tubes. Isolated cases of cellular degeneration have been observed in the meristematic region immediately below the extreme end of the sieve-tubes, but as a rule there is no perceptible evidence of the virus in this part of the root tips.

CARSNER (E.). **The present status of curly-top resistance in Sugar Beets.**—Abs. in *Phytopathology*, xxviii, 9, p. 669, 1938.

Under exposure to intensive infection by curly top [*R.A.M.*, xviii, p. 78 and preceding abstract], the U.S. 12 sugar beet variety [*R.A.M.*, xvii, p. 718] yielded 1·7 tons available sugar per acre as compared with a total root production of 1·6 tons from the European variety R[abbethge] & G[iesecke] Old Type. In a less severely exposed site U.S. 12 yielded 23·7 tons of beets and 3·2 of available sugar per acre compared with 10 tons of beets for R. & G. The U.S. 33 and 14 varieties are characterized by moderate resistance to curly top and high sugar content, but the adaptability of the latter variety is restricted by its susceptibility to downy mildew [*Peronospora schachtii*].

OSBORN (H. T.). **Incubation period of Pea virus 1 in the aphid Macrosiphum solanifolii.**—*Phytopathology*, xxviii, 10, pp. 749–754, 1938.

The exposure of successive series of healthy broad bean (*Vicia faba*) plants to colonies of the potato aphid (*Macrosiphum solanifolii*) allowed

to feed for short periods on the same host infected by pea virus 1 [enation mosaic: *R.A.M.*, xiv, p. 486; xvii, pp. 505, 575] showed the minimum and maximum times of incubation of the virus in the insect to be 12 and 18 hours, respectively. Aphids that had acquired the virus were found to retain it for as long as 21 days when fed continuously on non-susceptible tomato plants. Experiments on the transmission of the virus by the bean aphid (*Aphis rumicis*) gave negative results.

ARK (P. A.) & BARRETT (J. T.). **Phytophthora rot of Asparagus in California.**—*Phytopathology*, xxviii, 10, pp. 754–756, 1 fig., 1938.

A species of *Phytophthora* was responsible in March, 1938, for a soft, water-soaked, malodorous rot of Californian asparagus grown for the New York and Chicago markets (6 to 18·5 per cent. infection in a sample of field material examined and 20 to 30 per cent. in one from a packing-house). The fungus was killed by 15 minutes' immersion in 2 per cent. Labarraques solution (2·6 per cent. sodium hypochlorite), 10 minutes in 0·25 per cent. commercial ammonium hydroxide (28 per cent. strength), 5 minutes, ½ minute, and 5 minutes, respectively, in 0·25, 0·5, and 0·05 per cent. sodium peroxide, and 1 minute in water at 46° C., and none of these treatments caused any injury to the asparagus. Experimental treatments of asparagus with field infections gave a considerable degree of control. The disease was apparently promoted by persistent heavy rainfall and possibly also by the common practice of flooding certain areas to stimulate early growth.

JAGGER (I. C.), WHITAKER (T. W.), & PORTER (D. R.). **Inheritance in Cucumis melo of resistance to powdery mildew (Erysiphe cichoracearum).**]—Abs. in *Phytopathology*, xxviii, 9, p. 671, 1938.

Resistance to powdery mildew (*Erysiphe cichoracearum*) in the No. 45 cantaloupe, a cross between the very susceptible Hales Best and a highly resistant plant of an undetermined Indian variety and now the leading variety in the Imperial Valley, California [*R.A.M.*, xviii, p. 85], appears to be inherited as a simple Mendelian dominant factor. All the F_1 progeny of crosses between homozygous resistant and homozygous susceptible plants showed the same high degree of resistance as the resistant parent, while in the F_2, 233 resistant and 86 susceptible individuals were counted, approximating to the anticipated 3 : 1 ratio. Back-crosses between F_1 plants and the susceptible parent produced 21 resistant to 25 susceptible plants, which falls within the range of expectation for a 1 : 1 ratio.

WARE (W. M.). **Mushroom-growing.**—*Bull. Minist. Agric., Lond.*, 34, 80 pp., 20 figs., 1938. 1*s.* 6*d.*

This is a fourth revised edition of the Ministry's bulletin on mushroom-growing [*R.A.M.*, xiv, p. 490]. New sections on the preparation of manure and the value of spent compost have been added by N. H. Pizer, and the bibliography is extended to six pages.

HINO (I.). **Fruit-body of 'bukuryô'.**—*J. Jap. Bot.*, xiii, pp. 672–674, 2 figs., 1937. [Japanese, with English summary. Abs. in *Jap. J. Bot.*, ix, 3, p. (106), 1938.]

The author has been convinced of the validity of the scientific name

of *Pachyma cocos* [*R.A.M.*, ix, p. 572] for the Japanese 'bukuryô' by a comparative examination of a native specimen and herbarium material in the Natural History Museum, Paris, as well as by observations on the fruit body of the former.

HASIMOTO (A.). **The fruit-body of Pachyma hoelen Rumph.**—*J. Jap. Bot.*, xiii, pp. 824–825, 2 pl., 4 figs., 1937. [Japanese, with English summary. Abs. in *Jap. J. Bot.*, ix, 3, pp. (105)–(106), 1938.]

A fresh sclerotium of Japanese 'bukuryô' (*Pachyma hoelen*) [*P. cocos*: see preceding abstract] was kept perfectly dry for about a month and then embedded in wet sand for two years, water being added at regular intervals. At the end of this period, about one-tenth of the whole sclerotium was exposed, while the remainder was left embedded in the sand without any further addition of water. After some time a white, mould-like growth began to appear on the surface of the sclerotium and ultimately developed into a fruit body of *P. cocos*, otherwise almost unattainable.

Reports from the General Experimental Farms 1937.—*Pamph. Dep. Agric. Tanganyika* 21, 39 pp., 1938.

The following item of phytopathological interest occurs on p. 9 of this report. In further experiments in the isolation of cassava lines resistant to, or tolerant of, mosaic [*R.A.M.*, xvii, p. 649], seedlings remaining healthy when grown between rows of diseased setts in 1936 (the so-called 'bombardment' tests) were subjected to similar trials in field plots in 1937. Little infection occurred at first, but on pruning many plots succumbed, and only 7 per cent. remained free from either of the mosaic strains. Two imported types, however, show promise of resistance, namely, Kru from the Gold Coast and Turkey Claw from Trinidad, the latter remaining healthy even under 'bombardment'.

MOREAU (L.) & VINET (E.). **La défense du vignoble.** [The defence of the vineyard.]—220 pp., 47 figs., Paris, Librairie Ernest Flammarion, 1938. 18 francs.

This practical handbook gives concise descriptions of the diseases and pests of the vine, with instructions for their control. Chapters are also devoted to the resistance and susceptibility of various stocks to disease, cultural methods of improving vigour, critical periods of infection, spray warning services, and general considerations of control methods.

ADAM (D. B.). **The injury of Grapevines by lightning strike.**—*J. Aust. Inst. agric. Sci.*, iv, 3, pp. 162–164, 1 fig., 1938.

Vines of the Grenache variety, believed to have been struck by lightning, at Watervale, South Australia, exhibited defoliation, death, and greyish discoloration of the tops of a large proportion of the vertical shoots. The plants in the centre of the affected area were not entirely killed, for fresh shoots were growing from their bases. Many of the leaves on vines at the edge of the area were bright red and the cortical tissues of the stems, especially in the internodal region, were dead and split; beneath these dead tissues abundant callus developed, causing

enlargement of the node. Browning of short sections of the veins occurred on many leaves, and sometimes bunches of grapes were severely russeted and the berries split. Numerous fungi were observed on the dead tissues.

PERCHER (G.). **Quelques essais sur les soufres et sur les mouillants.** [Some experiments on sulphurs and wetters.]—*Rev. Vitic., Paris*, lxxxix, 2309, pp. 295–300, 2 graphs, 1938.

In experiments on the control of vine *Oidium* [*Uncinula necator*: *R.A.M.*, xvii, p. 726] the best results were given by dusting with flowers of sulphur. Applications of a 2 per cent. cupric spray plus flowers of sulphur incorporated by means of a commercial product 'A' gave satisfactory control but this treatment is not recommended alone, though the use of such a mixture with a smaller proportion of sulphur may well be successful against mildew [*Plasmopara viticola*] as well as *U. necator*, dusting with cupric sulphur being intercalated as required.

Studies are also reported on the wettability and adherence of three commercial wetters, A (as used above), B, and C. Laboratory tests with a Duclaux pipette showed that the wettability conferred by all three used at the usual dosages was less than that of black or even white soap. Used at the rate of 100 c.c. per hectol., mixture C gave the greatest wettability, followed by A and then by B, and field observations indicated a similar sequence; at double this concentration the corresponding order in laboratory tests was A, C, B. Examination by electrolysis of the deposits left on leaves sprayed at the weaker concentration showed that deposits of B, A, and C contained, respectively, 40, 32, and 25 mg. of metallic copper, adhesiveness thus being inversely proportional to wettability.

VAN POETEREN (N.). **Verslag over de werkzaamheden van den Plantenziektenkundigen Dienst in het jaar 1936. Verslag over de werkzaamheden van den Plantenziektenkundigen Dienst in het jaar 1937.** [Reports on the work of the Phytopathological Service in the years 1936 and 1937.]—*Versl. PlZiekt.Dienst Wageningen*, 87, 84 pp., 4 pl., 1937; 89, 82 pp., 4 pl., 1938. [Received January, 1939.]

The following are among the numerous items of interest (apart from those noticed from other sources) in these reports, compiled on the usual lines [*R.A.M.*, xvi, p. 299]. Brown heart of swedes occurred in several localities in 1936 and was partially or completely controlled in experimental plots by the application to the soil of borax [ibid., xvii, p. 284] or Chile saltpetre.

Young plum and cherry trees (under ten years) were attacked during the same year by *Bacillus spongiosus* [*Pseudomonas spongiosa*: ibid., xiii, p. 642] in a virulent form, and also suffered from crown die-back due to *B.* [*P.*] *mors-prunorum* [ibid., xviii, p. 88].

In 1936 *Sclerotium delphinii* severely attacked lilies growing in a plot occupied by irises in the previous year [ibid., xiv, p. 147 and below, p. 182].

The failure of a pea crop in 1937 is tentatively attributed to *Sclerotinia libertiana* [*S. sclerotiorum*], the occurrence of which on this host is somewhat exceptional [ibid., xv, p. 477; xvi, p. 435; xvii, p. 588].

Hitherto the symptoms of crown gall (*Bacterium tumefaciens*) on beets [ibid., xvi, pp. 235, 303; xvii, pp. 99, 659, *et passim*] were restricted in Holland to the roots, but in 1937 the pathogen was also found on the leaves. Severe mosaic symptoms were transmitted, evidently by insects, from beet to an adjacent spinach planting [ibid., xii, p. 673] in North Brabant. Other records for 1937 are as follows.

Chlorosis and premature death of flax plants were caused by *Phoma herbarum* [ibid., viii, p. 547], the pycnidia of which were found in abundance on diseased material.

Caraway [*Carum carvi*] plants with discoloured umbels yielding little or no seed were found to be infected by *Cercospora cari* [incorrectly cited as *C. carum carvi* in *R.A.M.*, iv, p. 312].

The meadow fescue [*Festuca elatior*] crop in an experimental grass planting was attacked by *Helminthosporium inconspicuum* [ibid., xii, p. 660], which may reduce the yield by up to two-thirds.

Cylindrocarpon radicicola [ibid., xi, p. 767; xvii, p. 113, *et passim*] was frequently isolated from damp, granular, brown lesions on the tuberous rhizomes of *Gloxinia* [*Sinningia speciosa*]. *Verticillium dahliae* was responsible for heavy damage among chrysanthemums [ibid., xvii, p. 584]. Lilac was attacked by *Pseudomonas syringae* [ibid, xiv, p. 319; xvii, p. 812], the development of which was no doubt favoured by the heavy rains during the winter of 1936–7. The leaves of a consignment of orchids (*Oncidium varicosum* var. *rogersii*) at Aalsmeer, imported from the Argentine, bore the unmistakable symptoms of a rust (*Hemileia oncidii* or *H. americana*), not previously observed in Holland. Satisfactory control was obtained by sponging the foliage with methylated spirit. *Pythium megalacanthum* [ibid., xvii, p. 374] caused extensive decay at Zouterwoede of the cuttings of various ornamentals, including chrysanthemums, *Pelargonium*, and *Primula*.

Italian poplars [*Populus nigra* var. *italica*] at Elst suffered heavy defoliation in August, 1937, as a result of infection by *Marssonina populi* [ibid., xv, p. 618]. The perithecial stage of the fungus (*Trochila* [*Pseudopeziza*] *populorum*) is formed on the dead leaves, which in nurseries should therefore be collected and burnt. Dead branch-tips should also be destroyed and two applications of Bordeaux mixture given, one just after the unfolding of the leaves and another when they are fully grown. Similar measures are recommended for the control of *M. salicicola* on weeping willows [*Salix babylonica*: ibid., xi, p. 139], the perithecial stage of which, however, has not been observed in Holland.

In the section devoted to experimental and research work mention may be made of the following items. *Fusarium avenaceum* was found to be the predominating organism in the diseased roots and discoloured stem bases of peas affected by foot rot [ibid., xvii, p. 432]; *F. sporotrichioides* [ibid., xi, p. 17] occurred twice and *F. culmorum* [ibid., xiv, pp. 613, 720] once. Full details are given of the operation of the potato blight [*Phytophthora infestans*] warning service [ibid., xiv, p. 13 *et passim*]. Two virulent rots of gladiolus corms are gaining ground, one caused by *F. oxysporum* var. *gladioli* [ibid., xvi, p. 335] and the other, falling into six types, by *Botrytis* spp. [ibid., xi, p. 244]; both disorders affect numerous popular varieties. Notes are given on preliminary tests with various plant protectives.

Ruszkowski (J.), Zweigbaumówna (Mme Z.), & Blockówna (Mme H.). **Stan zdrowotności roślin uprawnych w Polsce w roku 1937.** [Diseases of cultivated plants in Poland in 1937.]—*Roczn. Ochr. Rośl.*, v, 4, pp. 49–102, 1938.

Apart from the many well-known diseases mentioned in this report, it is stated that spindle tuber [*R.A.M.*, xviii, p. 50] and witches' broom of potato occurred in the Warsaw district.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, xlix, pp. 559–563, 6 figs., 1938.

Up to 1938, maize smut (*Ustilago zeae*) had occurred in New South Wales only in plots of maize grown under quarantine conditions, but in that year the disease caused extensive damage in a small area of commercially grown maize in the Bathurst district. The crop was later burned, and steps were taken to minimize the spread of spore material from the affected area.

Under the conditions prevailing in New South Wales the most suitable lettuce varieties resistant to downy mildew (*Bremia lactucae*) would appear to be Imperial D and F [*R.A.M.*, xvi, p. 550; xviii, p. 7], the former being best suited for winter conditions, and the latter for summer. If susceptible lettuces are grown in a seed-bed before being transplanted, infection can be materially reduced by spraying with Bordeaux mixture (1–1–10) during the first week of growth and again about four days before transplanting.

Internal cork of apples [ibid., xviii, p. 117] and cracking and die-back of pears have occurred for many years in New South Wales [ibid., xvi, p. 819], where both conditions readily respond to a soil dressing of 1 lb. of borax per tree.

Su (M. T.). **Report of the Mycologist, Burma, Mandalay, for the year ended 31st March 1938.**—10 pp., 1938.

The following are among the items of interest in this report [cf. *R.A.M.*, xvii, p. 444]. In one rice field, a plot receiving adequate water was only mildly affected by *Helminthosporium oryzae* [*Ophiobolus miyabeanus*], while an adjacent plot receiving less water was more severely infected. Over a number of years the disease has always been moderate on one experimental plot which receives abundant water, except in one season when there was a scarcity of rain and 'dry sowing' was adopted; on this occasion infection was heavy.

Laboratory tests showed that spores from sclerotia of *Ustilaginoidea virens* [loc. cit.] collected in December germinated up to but not after the following August.

A new disease of rice, associated with a species of *Pyrenochaeta*, produced a brown discoloration of the tissue just below the point of attachment of the leaf blade to the sheath, the blade being eventually shed. Much defoliation was caused when the disease occurred early.

Sugar-cane top rot, from the lesions of which a strain of *Fusarium moniliforme* [*Gibberella fujikuroi*] was isolated, was observed on a large scale for the first time in Burma. In one locality *Cercospora kopkei* [ibid., xv, p. 346] was very prevalent on the Co. 213 variety.

A fungus of the *F. vasinfectum* type isolated from wilted cotton plants was shown by inoculation experiments to be a virulent parasite.

Groundnuts were affected for the first time locally by a wilt disease, associated with *Macrophomina phaseoli* [ibid., xv, p. 648; xvi, pp. 87, 493], and a species of *Diplodia*.

Tobacco leaf curl [ibid., xviii, p. 90], first observed in 1935, caused 6·9, 3, and 1·1 per cent. infection, respectively, on the cigarette varieties Harrison Special, H. 142, and Adcock; the local Burmese variety showed 0·9 per cent. affected plants.

The incidence of mildew of betel vines (*Piper betle*), caused by a species of *Oidium*, was reduced from 10·32 to 8·12 per cent. by an application of a 0·5 per cent. suspension of a proprietary colloidal sulphur, the disease increasing in the unsprayed plot from 3·12 to 39 per cent. within a month.

In mangosteens (*Garcinia mangostana*) submitted to various treatments and placed in storage at 40° to 50° F., the lowest amount of rotting after one month was found in the lots wrapped in iodized paper. At room temperature (80°) the chief decay organism was *Diplodia* [*natalensis*: ibid., xvii, p. 445], followed by *Phomopsis* sp., and then by *Pestalozzia*, whereas at the lower temperature range this order was reversed. In many instances, infection began at the stem end.

In experiments with the edible straw mushroom (*Volvaria diplasia*) [ibid., xvi, p. 154] no difference in yield was obtained by inoculating each layer and alternate layers of straw. Fresh spawn gave a higher yield than old, and the use of spawn over four months old was uneconomical. An improved method of making spawn was devised, by which a culture of the fungus grown on Quaker oats agar was inoculated into bottles of autoclaved straw. Spraying the beds with 5 per cent. formalin solution directly infection by *Corticium* sp. [loc. cit.] was noted suppressed the disease and increased the yield. Attempts to cultivate *Agaricus* [*Psalliota*] *campestris* were unsuccessful at Mandalay, but gave very good results at Maymo. The best crops were obtained when the atmospheric temperature did not pass above 76° or below 39°.

New records for Burma, in addition to those already mentioned above, included *Oidiopsis taurica* on tomato and eggplant [ibid., xviii, p. 83].

Deighton (F. C.). **Mycological work.**—*Rep. Dep. Agric. S. Leone, 1937*, pp. 45–47, 1938.

This report [cf. *R.A.M.*, xvii, p. 161] contains, *inter alia*, the following items of interest. Further search for citrus scab (*Sphaceloma fawcettii* [*Elsinoe fawcetti*]) [loc. cit.] revealed its presence in only a very few localities in Sierra Leone. The few severely affected trees were destroyed, and those more lightly infected pruned. Pink disease (*Corticium salmonicolor*) was first recorded on citrus in Sierra Leone in December, 1937, a large seedling grapefruit tree being affected. The same disease was noted on cacao. A foot rot of a tangerine was associated with *Nectria flavolanata* [ibid., vii, p. 13].

Grapefruit trees at Freetown and Moyamba were affected by a disease of obscure origin resembling leprosis [ibid., xviii, p. 101], associated in the former locality with a *Colletotrichum*, probably present as a secondary infection, and in the latter with a *Pestalozzia*. Raised,

circular, light biscuit-coloured spots up to about ¼ in. in diameter, with a distinct margin, appeared on the young twigs and sometimes coalesced. Occasionally, a few pale brown spots appeared on the leaves and became perforated. In all other respects the trees were normal, and no economic importance is attached to the condition.

Tobacco leaf curl [see preceding abstract] was observed in three localities and is probably widespread, as leaf enations were noted on numerous wild plants, particularly *Stachytarpheta*. At Njala, Malayan varieties of beni (*Sesamum* sp.) and okra [*Hibiscus esculentus*] showed similar symptoms.

Plasmopara viticola was recorded on a wild host, *Cissus* [*Vitis*] *caesia*.

Cultures of *Myrothecium roridum* [ibid., xvii, p. 590] from Sierra Leone collections on leaves of *Dolichos lablab* and *H. esculentus* were ascertained by N. C. Preston to be strongly pathogenic to *Viola*, though a similar fungus from *Trichosanthes* was not pathogenic to this host.

New host records of *Macrophomina phaseoli* were African marigold (*Tagetes erecta*), *Cosmos sulphureus*, and *Zinnia*. Yam (*D*[*ioscorea*] *alata*) was affected by a mosaic disease, probably due to a virus. Records of entomogenous fungi, identified by Petch, included *Aschersonia badia* on aleyrodids on *Ficus capensis*, *A. placenta* on *Aleuromarginatus tephrosia* on *Tephrosia vogelii*, and *Empusa fresenii* on aphids [ibid., xii, p. 553] on *T. candida*.

Botany and plant pathology section.—*Rep. Ia agric. Exp. Sta., 1937–38*, pp. 103–121, 1938.

In further studies conducted in Iowa by H. C. Murphy, Mutica Ukraina (C.I. 3259) oats were found to be almost immune from races 33, 34, and 45 of crown rust [*Puccinia lolii*: *R.A.M.*, xvii, pp. 439, 664, 737], which attack the Bond variety, and from race 41, the only race to which Victoria oats are susceptible. Wild oats [*Avena fatua*] and a native strain from Uruguay (C.I. nos. 3416 and 3422, respectively), were almost immune from races 1 and 45.

In work by C. S. Reddy, only a trace of potato scab [*Actinomyces scabies*: ibid., xviii, p. 52] developed in field plantings of the resistant selection Minn. 35–26, U.S. 46000, U.S. 528-48, and U.S. 528–194, and the new variety, Houma, which has proved highly valuable in Louisiana.

C. M. Nagel states that sugar beet leaf spot (*Cercospora* [*beticola*: ibid., xvii, p. 719]) did not result in heavy reductions in yield or sucrose content in Iowa during 1937, although weather conditions strongly favoured infection, and the mildness of its effects is attributed to late planting (15th May to 15th June). Wider spacing gave control in experimental plots.

In studies by I. E. Melhus, Reddy, and W. F. Buchholtz, plantings of lucerne and red clover [*Trifolium pratense*] made on lucerne-sick land in four localities in southern, and four in central Iowa, gave poorer stands than plantings on land successfully planted to lucerne in the preceding five years. *Pythium de Baryanum* [cf. ibid., xv, p. 158] was isolated 55 times from 69 seedlings collected from the four fields in southern Iowa, and was also cultured from the soil and seedlings grown in soil collected from the four fields in central Iowa.

In the spring of 1938, 175 isolations from the roots of yellow, dwarfed oat seedlings grown in the field gave what appeared to be a species of

Pythium in 132 instances. When Gopher, Kanota, Iogold, Iowar, Iogren, D–67, Green Russian, and Swedish Select oats were sown in steamed soil inoculated with *P. de Baryanum* and *P. irregulare* [ibid., xvii, p. 476] the four last-named varieties gave under 60 per cent. germination under outdoor conditions in late March and the beginning of April compared with over 95 per cent. germination for all eight varieties on uninoculated steamed soil. Five weeks after sowing, the plants in the inoculated soil were very yellow, and by the seventh week they were also stunted, the basal leaves being dead, and the younger leaves dying from the tips down. The oats in the uninoculated soil, were green, showed only a few dead basal leaves, and were 6 to 8 in. higher. At 10° C., the Swedish Select variety gave 6 to 18 per cent. germination in soil inoculated with *P. de Baryanum* and 94 to 100 per cent. germination in uninoculated soil, while at 25°, the corresponding figures were 31 to 63 and 81 to 100 per cent. Root discoloration and necrosis were more severe at the lower than at the higher temperatures. In three experiments, intermediate temperatures gave intermediate results. Observations by Melhus, Reddy, Buchholtz, and Nagel showed that a total loss of sugar beets in one field resulted from late root rot due to *Aphanomyces cochlioides* [ibid., xvii, p. 428]; the disease became severe in four fields, and was present in over 25 per cent. of the fields round Kanawha by 1st July, 1937.

Melhus found that mulberry bacterial blight (*Pseudomonas* [*Bacterium*] *mori*) [ibid., xvi, p. 785] occurred on 25 to 75 per cent. of trees under an overhead irrigation system, infection causing slight leaf fall, with severe shot hole on most of the trees, whereas non-irrigated trees were only slightly affected.

A speedy test for the presence of the bacteriophage of *P.* [*Bact.*] *tumefaciens* [ibid., xvii, p. 659] in herbaceous plants was devised, in which sections of the stem are ground in sterile mortars with 10 to 15 c.c. of sterile distilled water, and allowed to extract for 15 minutes, after which the material is passed through a sterile Chamberland-Pasteur L3 filter candle. Inoculation of the sterile filtrate on to plates pre-seeded with *Bact. tumefaciens* produces plaques when the bacteriophage is present in the plant. By this method the bacteriophage was isolated from gall tissues and stem tissues 15 in. above the galls. When tomato plants, the roots of which had been cut off under water, were put in a 48-hour-old culture, the bacteriophage was recovered after six hours from stem sections made up to 18 in. above the base, but after 72 to 96 hours, recovery of the bacteriophage was no longer possible. The few bacteria isolated from the plants at the same time were not found to be pathogenic. When tomato plants whose roots had been cut off under water were placed in a 48-hour-old, bacteriophage-free, bacterial culture, it was possible to recover the bacteria in six hours from stem sections up to 12 in. above the base of the stem and such bacteria were highly pathogenic. After 72 to 96 hours it was occasionally possible to isolate a weak bacteriophage from the stem sections.

Siegler (E. A.). **Relations between crown gall and P_H of the soil.**—*Phytopathology*, xxviii, 11, pp. 858–859, 1938.

In order to verify the hypothesis that relatively alkaline soils may

be a predisposing factor in crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) infection, four adjacent rows of acid soil in the Sacramento River Valley, California, were selected for planting peach seed; two alternate rows were limed in the autumn of 1937, and a week later all four were heavily inoculated with an aqueous suspension of the organism. In the following autumn the incidence of infection in the limed (P_H 6·8) rows was 32 and in the acid (P_H 5) 3 per cent.

Nagy (R.), Riker (A. J.), & Peterson (W. H.). **Some physiological studies of crown gall and contiguous tissue.**—*J. agric. Res.*, lvii, 7, pp. 545–555, 2 figs., 2 graphs, 1938.

Analyses made of the galls (*Phytomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.*, xvii, p. 798] and contiguous tissue from tomatoes, red raspberry, and sugar beets, showed that the composition of gall tissue, which varied greatly according to the time of harvest and the species of plant, resembled generally that of young plants. The ash, total nitrogen, and simple forms of nitrogen were generally higher, and cellulose and pentosans lower, in the galls than in the uninfected tissue of tomato, whereas in sugar beets the galls had more cellulose and pentosans than the uninfected tissue. The glutathione content of the tomato galls was higher than that of the uninfected contiguous stem, but much lower than that of the growing tips, which also contained much more ascorbic acid. No considerable difference existed between the hydrogen-ion concentrations of the galls (P_H 5·72) and stems (P_H 5·79) of tomato. Calculated on the wet weight basis the catalase, oxidase, and peroxidase activity of the tomato galls were 160, 130, and 120 per cent. greater, respectively, than that of the contiguous stem tissues, the corresponding values when calculated on the basis of total nitrogen instead of wet weight being 86, 73, and 57 per cent, respectively. Alpha amino nitrogen and tyrosinase activity were, respectively, 20 and 200 per cent. greater in tomato galls than in the contiguous stems.

Stapp (C.). **Der Pflanzenkrebs und sein Erreger Pseudomonas tumefaciens. VI. Mitteilung. Asparagus sprengeri Rgl und Phaseolus vulgaris L. als Wirtspflanzen.** [Crown gall of plants and its agent *Pseudomonas tumefaciens*. Note VI. *Asparagus sprengeri* Rgl and *Phaseolus vulgaris* L. as hosts.]—*Zbl. Bakt.*, Abt. 2, xlix, 5–8, pp. 116–123, 6 figs., 1938.

Pursuing his studies on crown gall of plants (*Pseudomonas* [*Bacterium*] *tumefaciens*) [*R.A.M.*, xvi, p. 591], the writer reports the isolation of the organism from naturally occurring tumours on *Asparagus sprengeri* [ibid., xvi, p. 442] at the Dahlem Horticultural Institute and Juli beans (*Phaseolus vulgaris*) [cf. ibid., xvi, p. 799; xvii, p. 800] at a Mülheim (Ruhr) nursery.

The crown gall strain from *A. sprengeri* was also pathogenic to *Datura tatula*, sweet peas, tomato, sunflower, and *Pelargonium zonale*, whereas that from bean infected only its own host. The serological relationships of the two strains were also different, the *A. sprengeri* isolation agreeing in this respect with the *Dahlia variabilis* and *Chrysanthemum frutescens* strains, whereas that from bean gave divergent reactions. However, both strains formed stars in an iron-manganese-carrot juice medium and

their colour and morphological characters were identical. Evidence is adduced from comparative serological tests with named cultures of *Bact. tumefaciens* and inoculation experiments on known hosts of this organism that it, and not *Phytomonas fascians* [ibid., xviii, p. 33], is responsible for the development of tumours on *A. sprengeri*.

STAPP (C.) & MÜLLER (H.). **Der Pflanzenkrebs und sein Erreger Pseudomonas tumefaciens. VII. Mitteilung. Untersuchungen über die Möglichkeit einer wirksamen Bekämpfung an Kernobstgehölzen.** [Crown gall of plants and its agent *Pseudomonas tumefaciens*. Note VII. Investigations on the possibility of effective control in pome fruit orchards.]—*Zbl. Bakt.*, Abt. 2, xcix, 9–13, pp. 210–276, 13 figs., 3 graphs, 1938.

A comprehensive, fully tabulated account is given of the writers' recent investigations (in which they were assisted by F. Dame) at the Biological Institute, Dahlem, Berlin, on the practical possibilities of crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*) [see preceding abstract] control in apple and pear trees.

None of the 85 strains of the pathogen isolated directly by standard methods from apple and pear tumours [*R.A.M.*, vii, p. 231] showed any trace of virulence on inoculation into sunflower, *Pelargonium zonale*, and *Datura tatula*, and it was therefore necessary to secure inoculum for further tests by indirect means. Fragments of tumours from apple and pear were transplanted to sunflower, *P. zonale*, *D. tatula*, and tomato with positive results in six cases from pear to sunflower, in seven from pear to *D. tatula*, in one from apple to sunflower, and in seven from apple to *D. tatula*. The strains isolated in pure culture on bouillon agar from the excrescences thus induced were of only moderate virulence [cf. ibid., xiv, p. 740; xvii, p. 800], and showed less resistance to plant-protectives than the avirulent strains from apple and pear. A semi-total or complete loss of infectivity ensued when virulent cultures of *Bact. tumefaciens* were placed for periods of 1½ hours and upwards in extracts from the outer tissues of apple tumours before transference to an iron-manganese-carrot juice solution and subsequent inoculation into sunflower. Crown gall tumours on the apple thus appear to contain a substance causing an appreciable regression of pathogenicity in *Bact. tumefaciens*, a fact explaining the lack of virulence of most strains of the organism from pome fruits. The addition of α-alanin, a decomposition product of albumin, at the rate of 0·1 to 0·3 per cent., to a bouillon medium (diluted 1 : 10), induced a similar decline of virulence [ibid., xvi, p. 369], especially in the pear and hop strains, but whether this substance is identical with the inhibitory element in apple tumours is as yet unknown.

The different strains of *Bact. tumefaciens* used in these experiments varied in their pathogenicity towards apple and pear, the most virulent being that from hops, while no infection on either host was caused by the *Chrysanthemum frutescens*, willow, gooseberry, honeysuckle, or two free pear stock strains. The dahlia strain occupied an intermediate position, attacking one out of six apples and four out of seven pears (free stocks in both instances). Pears further proved moderately susceptible to infection by a crown gall strain from asparagus and two

from 'mauke'-diseased vines [ibid., xiv, pp. 499, 676, 740], all three of which were also pathogenic to *P. zonale* and tomato.

In experiments in 1937 the length of the incubation period of *Bact. tumefaciens* on pome fruits was found, in agreement with American work, to vary at different seasons. The shortest incubation period of 15 days was obtained for both apples and pears for inoculations performed at the height of summer (June–July) and the longest of 45 days, for apples in early spring. For pears the incubation period in spring and autumn was shorter than that for apples.

Bact. tumefaciens was shown to 'migrate' for considerable distances from the original foci of infection in its hosts, e.g., 120 cm. in an inoculated plant of *D. tatula* and up to 8 cm. above the galls on the roots of naturally diseased free pear stocks. The excision of the tumours thus affords no guarantee of actual freedom from infection, while free apple stocks, pruned back to the sound wood and grown in sterile soil, showed up to 35 per cent. crown gall at harvest time. Mechanical means of control are therefore ineffectual against crown gall, and the same was found to be true of 'physiological' measures, consisting in attempts to diminish the susceptibility of free apple and pear stocks in four nurseries comprising 30,000 trees by reducing the nitrogen and increasing the potash and phosphoric acid supplied. In laboratory tests the incorporation in a sterile soil medium of avirulent strains of *Bact. tumefaciens* from apple, pear, and rose with the virulent dahlia isolation led to a decline of infectivity in the latter, but in field experiments in infested soil a similar procedure gave negative results.

In 1936 and 1937 trials were carried out at the Biological Institute and several nurseries to ascertain the practicability of combating crown gall in free pear and apple stocks by various chemical preparations which had given promising results in preliminary laboratory tests. The influence of sulphur was found to depend largely on the reaction and buffering capacity of the treated soil, damage being caused to the plants by the application of as small a dose as 50 gm. per sq. m. to acid soils. Moreover, at the rate of 50 to 100 gm. per sq. m. sulphur is not entirely effective against crown gall, while larger quantities are apt to be injurious. Lime should be given during the previous autumn, and not simultaneously with the sulphur. The admixture of sulphur bacteria (*Thiobacillus thiooxydans*) with the sulphur was not as a rule beneficial. Of the 'dips' tested, 1 per cent. ceresan liquid (U 564a) in loam emulsion gave particularly satisfactory results, even better than uspulun (Saatbeize), which is apt to cause injury to the plants at 2 per cent. Uspulun-universal proved to be quite unsuitable for the purpose in view. In seed-bed tests 0·5 per cent. ceresan (10 l. per sq. m.) or sulphur (strewn over the surface at the rate of 50 gm. per sq. m.) definitely stimulated the emergence and vegetative development of the seed. With abavit-liquid the best results were obtained at 0·2 per cent.; this preparation, 1 per cent. ceresan, or 1 per cent. uspulun (Saatbeize) will give adequate control in slightly infested areas, whereas on very heavily contaminated plots the only completely efficacious substance was the highly toxic and altogether unsuitable mercuric chloride (15 to 20 gm. per sq. m.). It is therefore inadvisable to cultivate pome fruits in badly infected sites; elsewhere in the nursery a combination of soil

disinfection with sulphur (50 to 100 gm. per sq. m.) and immersion of the well-trimmed stocks in one of the above-mentioned fungicides may be recommended as the most practical method of crown gall control.

MATSUMOTO (T.) & SAWADA (Y.). **Bacteriophage specific for Bacillus aroideae.**—*Trans. nat. Hist. Soc. Formosa*, xxviii, 178, pp. 247–256, 1 fig., 1938.

The bacteriophage of *Bacillus* [*Erwinia*] *aroideae* was isolated from an aqueous suspension of crushed diseased radishes kept for about a fortnight at 10° C. It was experimentally shown to be specific in reaction. The potency of the lytic principle does not vary to any appreciable extent between 22° and 28° C., but a maximum appears to be generally reached at about 25°, a point considerably lower than the optimum for bacterial growth (28° to 31°). The plaques produced by the phage are very small (0·1 to 1, mostly under 0·5 mm.) on neutral potato dextrose, bouillon, or other agar media, of which the first-named, at a concentration of 2 per cent., was found to be the best for the production of clear, lytic spots.

BECK (E. C.). **The application of serological methods to the differentiation of closely related smut fungi.**—*Canad. J. Res.*, Sect. C, xvi, 10, pp. 391–404, 1938.

In further studies on the differentiation of closely related smuts by means of the reciprocal precipitin-ring test [*R.A.M.*, xiii, p. 435] antisera were prepared for *Ustilago avenae*, *Sorosporium reilianum*, *Sphaerotheca sorghi*, *U. zeae*, and *U. hordei* and were found to react specifically to extracts of the various fungi. The titre of an antiserum is defined as the highest dilution in which a continuous precipitin ring occurs between undiluted antiserum and its homologous antigen, and for the fungi studied the lowest titre was 1 in 3,200 whilst six possessed a titre of 1 in 12,800. Extracts of three monosporidial cultures of *U. zeae* (A, B, and C) isolated from a single chlamydospore and of two monosporidial cultures of *U. hordei* (A and B) also from a single chlamydospore, were distinguished as separate serological entities. Three antisera of *U. zeae* gave strong group reactions with *U. avenae* antigen but the antiserum of *U. avenae* was not reciprocally reactive with the antigens of *U. zeae*. The antiserum of *Sorosporium reilianum* gave marked group reactions with most of the antigens of other cultures, but the antisera of these cultures were not proportionately reactive with the antigen of *S. reilianum*. On the basis of these results it is concluded that the differences between titres of the antisera and non-specific reactions are great enough to serve as a basis for the identification of the members of this group. The only exceptions were *U. hordei* B and its mutant *U. hordei* C, which were found in two series of tests and in a reciprocal absorption test to be serologically identical. The optimal proportions of antigen and antibody for the reciprocal absorption test were found to be 1 : 10 and 1 : 1·25, respectively, but could not be used in absorption tests because of the dilution of the antiserum by the antigen. The agglutination test and the Widal or microscopical agglutination test were applied but gave unsatisfactory results.

Riceman (D. S.), Donald (C. M.), & Piper (C. S.). **A copper deficiency in plants at Robe, South Australia. 1. Preliminary investigations on the effect of copper and other elements on the growth of plants in a 'coasty' calcareous sand at Robe, South Australia. 2. The occurrence of reclamation 'disease' in cereals in South Australia.**—*Pamphl. Coun. sci. industr. Res. Aust.* 78, 28 pp., 6 pl., 1 fig., 1 graph, 1938.

In the first of these papers, Riceman and Donald give a fully tabulated account of investigations conducted in South Australia into copper deficiency-induced reclamation disease of wheat, oats, and barley in an area of blown calcareous sand, a preliminary description of which has already been noticed from another source [*R.A.M.*, xvii, p. 508].

In field tests carried out in 1937, 48 species of legumes, grasses, cereals, and other plants were sown in plots in the locality affected, the plots being given a basic dressing of 2 cwt superphosphate, 1 cwt sulphate of ammonia, and 2 cwt sulphate of potash per acre, and one of the following treatments: (1) cobalt chloride, 5 lb. per acre, (2) manganese sulphate and ferrous sulphate, each 28 lb. per acre, (3) no treatment, (4) copper sulphate, 28 lb. per acre, (5) copper sulphate, manganese sulphate, and ferrous sulphate, each 28 lb. per acre, and cobalt chloride 5 lb. per acre. In general, copper sulphate, alone or in the mixture containing it, markedly increased growth or period of survival. Manganese and iron produced only slight differences, chiefly limited to cereals, and cobalt chloride generally had a depressing effect. With lettuce, turnip, and tick bean (*Vicia faba*), the yield of the untreated plants in a given area was, respectively, 0·2, 13·2, and 4·7 gm. oven-dry weight, the corresponding figures for the copper-treated plants being 1·8, 45·7, and 46·7 gm., while the number of plants at the conclusion of the experiment in the same area in the untreated soil was, respectively, 3·3, 17, and 4·7 and in the copper-treated 12, 26, and 10·3. Of the cereals, rye developed normally without any treatment, and showed no response to the copper. The total yield (air-dry weight from a given area) of Gluyas wheat, Ghurka wheat, Mulga oats, and Prior barley from the untreated plots was 92, 29·3, 77·6, and 308·3 gm., respectively, the corresponding figures for the copper treatments being 317·4, 244·6, 293·4, and 350·8 gm. The mean total yield for all cereals except rye, per given area, amounted to 187·9 and 326·7 gm. in the untreated and copper-treated plots, respectively. In pot culture experiments, subterranean clover (*Trifolium subterraneum*) was grown in the soil in question with the addition of superphosphate only, superphosphate and potassium chloride only, and various minor elements mixed with the soil or sprayed in solution on the foliage, together with a basal dressing of phosphorus and potash. When the plants were harvested only those given copper plus cobalt were completely normal. The response to copper-cobalt applications would appear to be due to the former element.

In the second paper, Piper describes an experiment in which oats were grown in pots containing soil from the same locality, to some of which manganese sulphate was added. The manganese-treated plants remained healthy for about 14 weeks, while the others developed characteristic symptoms of manganese deficiency, but after 18 weeks all the plants developed symptoms of reclamation disease. Copper

sulphate was then applied to three pots, which quickly showed marked improvement, though the disease grew worse in the pots not receiving the copper. All the plants in the copper-treated pots finally showed greater weight of total dry matter than the controls.

In a field test in which copper sulphate was applied at the rate of 1 cwt per acre to oats in untreated soil and soil treated with manganese sulphate, the plants in both copper-treated parts recovered from the disease and produced normal ears, while the plants not treated with copper failed to ear. Oats growing in a portion of the paddock treated at sowing with a mixed fertilizer containing superphosphate, potash, copper sulphate, borax, and zinc sulphate were quite healthy, though the surrounding plants, in untreated soil, failed completely.

Sass (J. E.). **Abnormal mitosis in seedlings of some Gramineae following seed treatment.**—*Amer. J. Bot.*, xxv, 8, pp. 624–627, 20 figs., 1938.

A histological study of the root-tip cells of maize seedlings following four hours' immersion of the kernels and subsequent moistening of the root tips in a 1 in 2,000 suspension of ceresan [*R.A.M.*, xvi, p. 377] showed hypertrophy and abnormal mitosis in meristematic cells, attributed to the toxic action of ethyl mercury phosphate. During the prophases the nucleus seemed to be comparatively inert to the poison, but drastic disturbances took place during the anaphase, characterized by the formation of multipolar spindles and an irregular or incomplete separation of split chromosomes. The result of aberrant polarity during mitosis and aberrant anaphase separation, usually associated with the failure of cell-plate formation, was the production of giant cells, either multinucleate or with giant nuclei.

Similar abnormal cell division was observed in all meristematic regions of seedlings of *Avena strigosa* and *Holcus sorghum* grown from heavily dusted grain. The axillary buds in the germinating embryo of *A. strigosa* had multinucleate cells and polyploid nuclei.

Boewe (G. H.). **Naucoria on small grains in Illinois.** –*Phytopathology*, xxviii, 11, pp. 852–855, 1 fig., 1938.

English and Latin diagnoses are given of *Naucoria cerealis* n.sp., a weak parasite of wheat, barley, and rye in Illinois [*R.A.M.*, xvii, p. 737]. It is characterized by a thin, hemispheric, later expanded pileus, sometimes with a depressed centre and downward-turning margin, 1 to 2·2 cm. broad, glabrous, light buff, flesh whitish; adnate, broad, thin, chestnut-coloured lamellae; golden-brown spores, oval in one view but asymmetrically oval in the other, with a gelatinous apicule covering the germ pore, smooth, 9·9 to 16·5 by 6·9 to 9·9 μ, generally 12·5 to 13·5 by 7 to 8·5 μ; and a stipe equal, slightly bulbous at the base, glabrous, light buff, stuffed, becoming hollow, the upper part striate, 2 to 4·6 cm. long, and 1 to 1·5 mm. thick.

Straib (W.). **Ergebnisse und Probleme der Getreiderostforschung.** [Results and problems of cereal rust research.]—*Angew. Bot.*, xx, 5, pp. 349–365, 1938.

This is a critical review and discussion of the work already accom-

plished and that remaining to be done on some outstanding problems of cereal rust (*Puccinia* spp.) research, with special reference to German conditions, e.g., physiologic specialization, varietal resistance, environmental factors in relation to resistance, and inheritance of resistance [cf. *R.A.M.*, xvi, p. 235].

VANTERPOOL (T. C.) & SIMMONDS (P. M.). **The relation of browning root rot to stem rust in causing injuries to Wheat.**—*Sci. Agric.*, xix, 2, pp. 81–82, 1938.

The results of observations in 1938, in a wheat field at Saskatoon, Saskatchewan, which earlier in the season had shown considerable browning root rot (*Pythium* spp.) [*R.A.M.*, xvii, p. 796] in certain well-known diseased areas, showed that on 3rd August the wheat in the healthy areas was quite mature (kernels in the dough stage and most of the straws ripe), and only a trace of stem [black] rust (*Puccinia graminis tritici*) was present on the plants. In the diseased areas, on the other hand, the wheat kernels were in the late milk stage and the plants green; the rust on these plants was estimated at 20 to 30 per cent., extending up to the peduncle and head. On 11th August, when the crop was being cut, the plants in the healthy areas were estimated to be 90 per cent. mature, with the kernels in the firm dough stage, and with only a trace of rust on the straws. The threshed grain gave a yield of 33 gm. per 50 heads, and weighed 61·2 lb. per bush., being graded a poor No. 1 on account of some green kernels. In the diseased areas, however, the plants were still quite green, and the kernels in the late milk or early dough stage; rust was estimated at 35 to 40 per cent. The yield was 24·95 gm. per 50 ears, and the grain weighed 57·2 lb. per bush. and graded a good No. 4. While admittedly only indicative, the data suggest that had it not been for the delay in maturity caused by the root rot, the damage from rust would have been negligible and the grain of good quality. This is in agreement with the experience of many farmers from time to time during the last 20 years and with the established observations of plant pathologists.

LUNGREN (E. A.) & DURRELL (L. W.). **Black stem rust control in Colorado.**—*Bull. Colo. agric. Exp. Sta.* 447, 18 pp., 7 figs., 3 maps, 1938.

In this paper the authors report the progress made in the barberry (*Berberis* spp.) eradication campaign against black stem rust (*Puccinia graminis*) of grain crops in Colorado, where the annual loss due to this disease is put at 335,000 bush. of small grains. Locally, the chief sources of early infection are *B. vulgaris* and *B. fendleri* [*R.A.M.*, vi, p. 471]. Epidemics affecting several square miles may arise from a single barberry bush. Wind-borne spores from neighbouring States sometimes reach Colorado in time to damage grain crops before they mature, but infection from this source generally appears from two to three weeks after that which develops in the vicinity of local barberries. Besides barberry eradication and the use of rust-resistant varieties, it is recommended that spring wheat should be sown as soon as the soil can be made ready.

Leszczenko (P.). **Badanie nowych środków do zaprawiania zbóż przeciw grzybkom głowniowym.** [Tests of new cereal seed disinfectants against smut fungi.]—*Roczn. Ochr. Rośl.*, v, 4, pp. 103–108, 1938.

In tests carried out in 1937–8 in Poland, seed-grain of Trotzkopf wheat and Puławskie rye was artificially inoculated with spores of *Tilletia tritici* [*T. caries*: *R.A.M.*, xv, p. 285] and *Urocystis occulta* [loc. cit.], respectively, and treated with various disinfectants. The untreated controls yielded an average for the two years of 37·2 per cent. affected wheat ears and 39·15 per cent. diseased ears of rye, the corresponding figures for treatment with formaldehyde (0·1 per cent. solution, 30 minutes' soaking) being 0·25 per cent. for both wheat and rye, for abavit (0·2 per cent. solution) 0·25 per cent. for wheat and 0·35 per cent. for rye, and for the same (0·3 per cent. solution) 0·1 per cent. for both wheat and rye. Ziarnik, zbożak, and uspulun used in a 0·2 per cent. solution were ineffective, but at a strength of 0·3 per cent. the results were nearly as good as those obtained with formaldehyde.

Sempio (C.). **Su un caso sperimentale di netto antagonismo in vivo ('Tilletia caries'—'Erysiphe graminis' su 'Mentana').** [On an experimental case of distinct antagonism *in vivo* (*Tilletia caries*—*Erysiphe graminis* on Mentana).]—*Riv. Pat. veg.*, xxviii, 9–10, pp. 377–384, 1 fig., 1938.

In this preliminary account of his investigations, the author states that on 3rd March, 1937, he planted 60 to 70 healthy seeds of Mentana wheat in each of three pots and the same number of seeds heavily infected with *Tilletia caries* [see next abstracts] in three others. On 4th April, all the seedlings were abundantly infected with a suspension of the conidia of *Erysiphe graminis*, placed in a damp chamber for 48 hours, and then kept at a relative humidity of 80 to 95 per cent. for the remainder of the experiment.

On 16th April, all the plants were observed to show infection by *E. graminis* but those grown from the clean seeds were more severely attacked than those from the bunted seeds. This difference became progressively more marked, and by 25th April, many of the plants from the clean seed were dead, while those from the bunted seed were only severely mildewed. All the seedlings were then dusted with sulphur, the operation being repeated a few days later. When the ears had matured, the seedlings grown from the bunted seed showed 185 ears (18 clean and 167 bunted), while those from the clean seed had only 52 ears.

The author considers that *T. caries* probably liberated substances toxic to the mildew and also stimulated the powers of resistance of the wheat.

Sempio (C.). **Effetto delle alte temperature sul Frumento cariato al momento della spigatura.** [The effect of high temperatures on bunted Wheat at the time of earing.]—*Riv. Pat. veg.*, xxviii, 9–10, pp. 385–387, 1938.

When wheat seedlings grown from seed heavily inoculated with spores of *Tilletia tritici* [*T. caries*] were exposed 8, 16, 30, and 60 days after sowing to a temperature of 32° to 33° C. until the booting stage was reached, the percentage of bunted ears that formed subsequently was

much lower than in the case of the inoculated controls not exposed to this temperature. Exposure of infected seedlings in a later stage of growth to the same temperature resulted in the ears that survived the treatment (approximately one-third of the number that formed in the unexposed controls) being mostly healthy, though almost all the unexposed control ears were infected. When three pots of seedlings grown from inoculated Virgilio seed were exposed to this temperature for 4, 5½, and 5½ days, the plants subsequently showed, respectively, 13, 1, and 5 completely bunted ears, 0, 0, and 3 partially bunted, and 5, 8, and 4 healthy, the corresponding figures for the unexposed controls being, 21, 37, and 30; 1, 0, and 0; and 0, 2, and 2. It would appear that infected wheat seedlings must remain exposed to a temperature of 32° for at least five consecutive days before *T. caries* is definitely arrested.

Sempio (C.). **Influenza di alcune sostanze, date alle piantine per assorbimento, sullo sviluppo della carie del Grano. (Nota preventiva).** [The influence of some substances, absorbed by young plants, on the development of Wheat bunt. (Preliminary note).]—*Riv. Pat. veg.*, xxviii, 9–10, pp. 399–400, 1938.

Seeds of Virgilio wheat heavily inoculated with spores of *Tilletia tritici* [*T. caries*] were sown in pots, and 60 days later the seedlings were transferred to a nutrient solution to which was added one of a number of various substances (including alkaloids, phenols, glucosides, and metals), the solutions being renewed at intervals of five days. After 20 days the seedlings were planted out in cement containers. When the ears had fully developed it was observed that the only substances that had exercised any definite effect on infection were nickel, cadmium, and salicylic acid which gave, respectively, 40, 40, and 26 completely bunted ears, 3, 6, and 1 partially bunted, and 8, 4, and 6 clean, as against 56 completely bunted, and no partly bunted or clean ears in the controls.

Dionigi (A.). **Sullo svernamento delle ruggine. (Nota II.).** [On the overwintering of rusts. (Note II).]—*Riv. Pat. veg.*, xxviii, 9–10, pp. 401–404, 1938.

In this paper on the mode of perpetuation of rusts (*Puccinia*) [*glumarum*, *P. graminis*, and *P. triticina*] [*R.A.M.*, xvii, p. 164] the author presents data considered to demonstrate that these rusts do not have continuous cycles of activity. He adduces further evidence of a dormant state for the uredospores of these rusts, based on the absence of infection of wheat sown in summer in soil inoculated with rust spores, whereas wheat sown in autumn in similar soil developed rust at the usual time.

Straib (W.). **Untersuchungen zum Verlauf der Herbstinfektion und Überwinterung des Gelbrostes auf Weizen und Gerste.** [Investigations on the course of autumn infection and overwintering of the yellow rust on Wheat and Barley.]—*Phytopath. Z.*, xi, 4, pp. 331–359, 4 graphs, 1938.

In field experiments, carried out from 1934 to 1938 at Gliesmarode, Brunswick, a large number of wheat varieties were artificially inoculated each autumn with the physiological races 2, 7, and 9 of *Puccinia*

glumarum [*R.A.M.*, xvii, pp. 231, 307], 12 varieties of barley inoculated with race 23 being included in the last experiment. Infection was favoured by mild, moist weather and consequently succeeded better in early sown wheats, and was also more profuse in wheat varieties with pendent leaves. 'Absolutely resistant and immune' varieties showed no infection, but those relatively resistant at 12° C. in the greenhouse test were fairly susceptible under conditions of low autumn temperatures in the field. All four races under consideration were found capable of overwintering on susceptible varieties of the appropriate hosts. The capacity for overwintering varied considerably in the different years, being apparently dependent on soil and weather conditions in February and March; the growth of mycelium and spore formation were arrested by wet, cold weather in spring, which killed the old leaves, the chief bearers of yellow rust. Under conditions of equal initial infection in autumn more rust overwintered on susceptible varieties, especially on those with pendent leaves, than on resistant; with varying degrees of initial infection the percentage of overwintering on susceptible varieties increased in proportion to the primary incidence of the disease.

The overwintering of rust under the climatic conditions of central and north Germany is considered to be less dependent on the winter-hardiness of a cereal variety than on the length of life of old autumn leaves, conditioned by factors of soil, weather, and nutrition. Slow growth of mycelium, long periods of incubation, and prolonged spore formation are of primary importance in the overwintering of the uredo stage. Secondary infection during the winter months was also observed, and was found to be particularly favoured by the higher infective capacity of winter uredospores, which also remained viable for a longer period than summer ones, an important factor in the epidemiology of the rust. Couch grass [*Agropyron repens*], which is generally resistant to rust infection in summer, was found to be heavily infected in autumn. In this respect it resembles the relatively resistant wheat varieties.

RALSKI (E.). **Die Empfänglichkeit des Weizens für den Braunrost Puccinia triticina Erikss.** [The susceptibility of Wheat to the brown rust *Puccinia triticina* Erikss.]—*Phytopath. Z.*, xi, 4, pp. 447–449, 1938

An account of the work presented in this paper has already been noticed from another source [*R.A.M.*, xvi, p. 372]. Although none of the wheat varieties native to Poland was absolutely resistant to *Puccinia triticina* in the field, the native winter wheat Ostka Gruboklosa was found to be fairly resistant and the native summer variety Puławska Twarda highly resistant, while of the foreign wheats Carman I. and Rikuun, both of the infection type 1 to 2, deserve to be mentioned.

CHURCHWARD (J. G.). **Studies on physiologic specialization of the organisms causing bunt in Wheat, and the genetics of resistance to this and certain other Wheat diseases. Part ii. Genetical studies.** —*J. Roy. Soc. N.S.W.*, lxxi, pp. 547–590, 2 pl., 3 graphs, 1938.

In continuation of his earlier studies [*R.A.M.*, xvii, p. 804] the author has investigated the inheritance of resistance to bunt (*Tilletia tritici*) [*T. caries*], flag smut (*Urocystis tritici*), and two races of stem [black]

rust (*Puccinia graminis*) and certain morphological characters of the wheat cross Federation × Hope both in the greenhouse and in the field at Richmond, New South Wales, and at St. Paul, Minnesota. Field results obtained with five generations from one collection of *T. caries* indicated that in addition to a single major factor for resistance to bunt this cross probably possesses at least one minor modifying factor which allows the development of bunt in certain families. The resistance of the cross to *P. graminis* race 34 was determined in the field by at least two major factors and probably several important modifying ones; and in the greenhouse there was complete dominance of susceptibility to race 34 and dominance of resistance to race 33, the single factors involved being inherited independently of those for resistance in the field. The dominant reaction of the cross to *U. tritici* remained unknown in the absence of F_1 and F_2 data, but the results for the F_3 generation in the greenhouse indicated the operation of a single major factor for resistance. In this cross there was a loose linkage between the genes determining resistance to bunt and flag smut and also to race 34 of black rust in the field and late maturity, and a very weak linkage between resistance to bunt and resistance in the greenhouse to races 33 and 34 of black rust.

Discussing the recent advances in the genetics of bunt, the author stresses the importance of environmental factors in genetic studies, recommends the adoption of uniform criteria for susceptibility and resistance, and urges the standardization of experimental technique.

SALMON (S. C.). **Generalized standard errors for evaluating bunt experiments with Wheat.**—*J. Amer. Soc. Agron.*, xxx, 8, pp. 647–663, 5 graphs, 1938.

Data are presented from tests conducted by Rodenhiser and Holton in connexion with their studies on physiological races of wheat bunt [*Tilletia caries* and *T. foetens*: *R.A.M.*, xvii, p. 164] to determine varietal differences in infection which show that the estimation of random variation by analysis of variance, or by any method involving the grouping together of all varieties irrespective of bunt incidence, may be seriously in error when varieties differing materially in susceptibility are included. The binomial and chi-square determinations, as generally used for the evaluation of statistically significant differences, are also unreliable for bunt resistance tests, since they take into account only the random variation due to simple sampling and do not allow for environmental heterogeneity (principally in relation to soil differences).

The standard error was found to be largely dependent on the incidence of infection, approaching 0 at 0 and 100 per cent. and reaching a maximum at or near the 50 per cent. level. The introduction of a constant into the binomial formula to allow for random errors, other than those due to simple sampling, makes possible the fairly accurate prediction of standard errors when the observed standard error for any given level of infection is known.

A method of estimating standard errors for grouped bunt data is suggested, involving the fitting of infection curves to observed standard errors. For instance, at Bozeman, Montana, a curve fitted for the range from 0 to 35 per cent. bunt in spring wheat might be expected to yield reliable estimates of standard error within this range. While somewhat

empirical, since the results are partially dependent on the size of the bunt classes, the proposed method of estimating standard errors is considered to be much more reliable than those in current use.

Schlehuber (Alva M.). **The inheritance of reaction to physiologic races of Tilletia tritici (Bjerk.) Wint. in a winter Wheat cross.** *Res. Stud. St. Coll. Wash.*, vi, 2, pp. 75–96, 3 graphs, 1938.

Investigations [which are fully described] into the inheritance of the individual reactions in the winter wheat cross White Odessa (C.I. 4655) × Turkey-Florence (C.I. 10080) to two physiologic races of *Tilletia tritici* [*T. caries*], Ft–4 [*R.A.M.*, xvii, p. 305] and one isolated originally on Ridit wheat, and referred to as Ridit *tritici*, showed that neither the high susceptibility of White Odessa nor the high resistance of Turkey-Florence to Ft–4 was recovered in 108 families of the F_3 progeny. At least four genes controlling resistance to Ft–4, all cumulative in their effect, appear to be present. Both parents were found to be moderately susceptible to Ridit *tritici*. About 18·75 per cent. F_3 families were more resistant than White Odessa, and an equal percentage more susceptible than Turkey-Florence, to Ridit *tritici*. White Odessa appears to be of the constitution AABB and Turkey-Florence aabb, the percentage of bunted plants of the former averaging about 56, and those of the latter about 76. The F_3 families segregated in accordance with the Mendelian ratio 9 : 3 : 3 : 1. Transgressive inheritance in reaction to Ridit *tritici* was established in the F_4 progeny.

The reaction of White Odessa, Turkey-Florence, and 76 of their F_3 families to an equal mixture of Ridit *tritici* and Ft–4 showed that the average percentage of bunt in the parents produced by the mixture varied comparatively little from the percentage produced by the race to which the variety is the more susceptible. The author states, however, that in mixtures of numerous races the non-virulent races inhibit the effectiveness of the virulent races much more than if only two races are used, probably owing to the dilution of the virulent inoculum. The reaction of the F_3 families to the mixture is similar to that obtained from Ridit *tritici*. Because of the lack of correlation between infection by Ft–4 and Ridit *tritici* it is concluded that resistances to these two races are controlled by completely different genes. The high correlation between the results for Ridit *tritici* and the mixture suggests that resistance to the mixture of the two races largely depends on the factors controlling resistance to Ridit *tritici*. Since the reaction to Ft–4 involves four factors and that to Ridit *tritici* two, at least six genes must operate in the resistance to the mixture.

Jones (G. H.) & El Nasr (A. El G. S.). **Control of four smut diseases by regulation of planting method under irrigation.**—*Nature, Lond.*, cxlii, 3603, pp. 917–918, 2 graphs, 1938.

Experiments were carried out in the Cairo district to determine the effect of different planting methods on flag smut [*Urocystis tritici*: *R.A.M.*, xvi, p. 167] and bunt of wheat [*Tilletia foetens*], covered smut of barley [*Ustilago hordei*: ibid., xiv, p. 158], and grain smut [*U. panici-miliacei*] of millet [*Panicum miliaceum*: ibid., xvii, pp. 434, 628]. When the seed was [illegible] on moist soil and ploughed in (herati

method), there was two to three times more flag smut [ibid., xiv, p. 24], six times more covered smut of barley [ibid., x, p. 448], five times more wheat bunt [cf. ibid., xvii, p. 14], and also more millet grain smut than in plants from seed broadcast on dry soil, harrowed in with a wooden baulk, and irrigated (afir method). In one experiment with flag smut the herati method (sowing depth 8 cm.) gave 8·6 per cent. infection, the afir method (sowing depth 4 cm.) 3·2 per cent., and mud sowing by flooding dry soil and broadcasting the seed one hour later, 0·08 per cent., and in another experiment the herati method gave 8·1 per cent., a modification of the afir method (whereby the broadcasted seed was covered by raking instead of by harrowing, giving a sowing depth of 2·5 cm.) 2·4 per cent., and mud sowing by ploughing and flooding moist soil followed by broadcasting the seed one hour later 0·2 per cent. The progressive increase of infection at the deeper soil layers may be due to the longer susceptible stage of the seedlings, while the strikingly low incidence in the shallowest sowings is possibly attributable to the development of the coleoptiles in the air rather than in damp soil. The practical applications of these data to irrigation farming are very briefly indicated.

Allen (P. J.) & Goddard (D. R.). **A respiratory study of powdery mildew of Wheat.**—*Amer. J. Bot.*, xxv, 8, pp. 613–621, 6 graphs, 1938.

In addition to the results already published in the preliminary report of this study [*R.A.M.*, xviii, p. 14] the authors found that in a later experiment the oxygen consumption by mildewed wheat was 650 per cent. greater than normal. The respiratory rate of the first leaves of healthy wheat is high during the first few days but reaches a fairly constant level after nine days from the time of planting, whereas on inoculation with mildew (*Erysiphe graminis* var. *tritici*) the rate rises, becoming after two days twice as high as that of healthy wheat. The maximum is reached about six days after inoculation, from which day onwards the respiration of the wheat is always about 3·4 times as high as that of the mildew, this constant relation between the respiration rates of host and fungus persisting through a series of rather large subsequent fluctuations. Within temperature limits between 12° and 30° C. an increase of temperature was found to increase the rate of oxygen uptake in both healthy and mildewed wheat, respiration increasing more rapidly in the former over high than over low temperature ranges, while the opposite holds good for the latter. The results show that infection of wheat with *E. graminis* causes an increase in the rate of respiration of the mesophyll tissues roughly proportional to the degrees of infection. It is suggested that a diffusible substance is produced by the mildew, or possibly by the epidermal cells, which passes out into the mesophyll and brings about an increase, more or less permanent, in the rate of respiration.

Garrett (S. D.). **Soil conditions and the take-all disease of Wheat. III. Decomposition of the resting mycelium of Ophiobolus graminis in infected Wheat stubble buried in the soil.**—*Ann. appl. Biol.*, xxv, 4, pp. 742–766, 1 pl., 12 graphs, 1938.

In continuation of the author's study on the take-all disease of wheat

(*Ophiobolus graminis*) [*R.A.M.*, xvii, pp. 230, 592], pieces of artificially infected wheat straw were buried in variously treated soils contained in glass tumblers, and were examined at fortnightly intervals over a period of 18 weeks for the presence of viable resting mycelium by means of a wheat seedling test. The results suggest that decline in the viability of the resting mycelium in infected wheat straw is due to its natural decomposition by other soil micro-organisms, since it was possible to correlate the decline with the microbiological activity of the soil throughout the experiments. The viability of the resting mycelium persisted apparently undiminished in dry air, sand, air-dry soil, in soil at 2° to 3° C., and under sterile conditions in the culture flask. The decline of viability was less rapid in a waterlogged soil than in one maintained at a medium moisture content; it was accelerated by the addition of energy materials containing little or no nitrogen, such as glucose, starch, and rye grass meal, to the soil; it was more rapid in a partially sterilized and reinoculated soil than in an untreated one. The rate of decline varied with the type of the soil, being more rapid in rich and heavy soils than in poor, light ones; it was apparently not directly affected by soil reaction, nor appreciably by moisture content of the soil over the range 30 to 80 per cent. saturation, and was more rapid under conditions of fluctuating soil moisture and improved aeration in unglazed pots than under more uniform conditions in glass tumblers; decline was slowest in a small closed incubator. Thus, the most rapid disappearance of the resting mycelium of *O. graminis* was observed under conditions favouring a rise in number and activity of soil micro-organisms. The decline in viability of the resting mycelium did not necessarily proceed parallel with the decomposition of the straw as a whole; it was delayed by the addition to the soil of dried blood containing 13 per cent. nitrogen, which accelerated the decomposition of the straw, and was expedited by the addition of rye grass meal, which delayed decomposition of the straw by taking up the available nitrogen. It is suggested that the mycelium itself may serve as a source of nitrogen for the decomposition of the straw and that the addition of substances rich in nitrogen protect it from the nitrogen demands of the organism engaged in decomposing the straw.

Leukel (R. W.), Stanton (T. R.), & Stevens (H.). **Comparison of different methods of inoculating Oat seed with Smut.**—*J. Amer. Soc. Agron.*, xxx, 10, pp. 878–882, 1938.

The results of studies at the Idaho Agricultural Experiment Station on the relative merits of different methods of inoculating oats with loose and covered smuts (*Ustilago avenae* and *U. levis* [*U. kolleri*: *R.A.M.*, xvi, p. 807]), using the moderately susceptible Iogold, extremely susceptible Victory, and resistant Markton varieties (the last-named in one test only), showed that the immersion of the seed in a spore suspension under vacuum may give as high infection percentages as those arising from hulling the seed and dusting it with spores. Inoculation by the latter method may cause a severe reduction in emergence and stand, even in resistant varieties, besides being extremely laborious. The suspension-vacuum method offers a quick and

effective means of inoculating large numbers of oat seeds with the two smuts under observation.

HUTCHINS (H. L.) & LUTMAN (B. F.). **Spine development on the spores of Ustilago zeae.**—*Phytopathology*, xxviii, 11, pp. 859–860, 1 fig., 1938.

A brief account is given of the process of spine development from a gelatinous matrix on the spores of *Ustilago zeae*, in the accurate observation of which an adaptation of W. G. Hutchinson's stain combination of orseillin BB with aniline blue was found extremely effective. The spines emerged as minute, acuminate, knob-shaped, or conical structures, gradually changing from vivid red to grey and finally brown, from the blue-stained jelly of the rudimentary spore walls, the alteration in colour being associated with the impregnation of the protuberances with chemicals other than cellulose or lignin. The jelly surrounding the spines appeared to collapse and disappear in the later stages.

KOEHLER (B.) & WOODWORTH (C. M.). **Corn-seedling virescence caused by Aspergillus flavus and A. tamarii.**—*Phytopathology*, xxviii, 11, pp. 811–823, 3 figs., 1938.

Virescence of maize seedlings, indistinguishable from that heretofore attributed exclusively to genetic factors, was induced at the Illinois Agricultural Experiment Station by inoculation of the seed with *Aspergillus flavus* or *A. tamarii* [*R.A.M.*, xiv, p. 355]. The chlorophyll deficiency associated with both the hereditary and acquired forms of the disorder is aggravated by insufficient light (daylight only as opposed to continuous illumination), low soil temperatures (16° to 18° compared with 30° C.), and a relatively high soil moisture content (27 as against 18 per cent.); the development of virescence was further shown to be generally promoted by storage of the soils for three months or more without cropping prior to experimental use. Under appropriate conditions a high proportion of the open-pollinated maize varieties of the dent, sweet, pop, flint, and flour types tested developed induced virescence, and, with a few exceptions, the inbred lines were also susceptible. The rupture or partial removal of the seed coat was necessary to ensure effective inoculation; good results were obtained by shaving off the seed coat from the crowns of the kernels before shelling the ear. Ten isolations of *A. flavus* and two of *A. tamarii* from various sources were all instrumental, though not of equal potency, in causing virescence, which did not result, however, from infection by a number of other species. In simultaneous inoculation tests the admixture with *A. flavus* suspensions of 10^7 spores per c.c. of an equal spore volume of *A. niger*, *Penicillium viridicatum*, *P. notatum*, *P. expansum*, or *Fusarium moniliforme* [*Gibberella fujikuroi*] substantially reduced the extent of virescence caused by the first-named.

MCNEW (G. L.). **The relation of nitrogen nutrition to virulence in Phytomonas stewarti.**—*Phytopathology*, xxviii, 11, pp. 769–787, 2 figs., 1 graph, 1938.

Ten strains of *Phytomonas* [*Aplanobacter*] *stewarti* differing in virulence towards Golden Bantam maize seedlings [*R.A.M.*, xvii, pp. 740,

810] were found to possess the following identical characters. All consisted of small, Gram-negative, non-motile, asporogenous rods. None produced indol from tryptophane or gas from carbohydrates. All caused similar changes in the acidity of media containing different carbohydrates and gave rise to the same type of growth on potato slants. The differences noticed were as follows. Two slightly virulent strains failed to utilize nitrogen from inorganic sources, two others formed small, firm, yellow colonies on nutrient dextrose agar poured plates, and the most strongly pathogenic reduced nitrates to nitrites and produced a curd in litmus milk.

The ability to utilize inorganic nitrogen was experimentally shown to be invariably correlated with virulence. Growth on a synthetic agar medium containing no organic nitrogen increased the pathogenicity of slightly virulent cultures, presumably by a course of continuous intensive selection of variants. By repeated selection of the most virulent variants occurring in dilution plates from cultures on nutrient agar it was possible to derive a virulent culture from a mildly pathogenic strain by a process analogous to that occurring in the host.

Most of the virulent strains utilized ammonium nitrogen much more readily than nitrate nitrogen. The most severely pathogenic (B–Gl) of all those tested reduced nitrates to nitrites in a medium containing both ammonium and nitrate nitrogen. This and other virulent strains produced nitrites in badly wilted plants, but the nitrites were shown not to be the sole cause of the symptoms.

WANG (C. S.). **The formation of chlamydospores of Ustilago crameri Kcke. on artificial media.**—*Phytopathology*, xxviii, 11, pp. 860–861, 1938.

In monochlamydospore cultures of *Ustilago crameri* [the agent of kernel smut of millet (*Setaria italica*) in China: *R.A.M.*, xvi, pp. 247, 741], grown on 1, 2, or 3 per cent. potato dextrose or malt agar for ten weeks at room temperature, numerous intercalary chlamydospores were produced, mostly from hyphal strands but occasionally by mycelial fragmentation into short segments. Most of the hyphal cells were binucleate, but uninucleate ones were not uncommon and a few multinucleate individuals were observed. The fusion of two nuclei into one was mostly detected during the process of gelatinization of the enlarging mycelial cells which constitutes the first step in chlamydospore formation. The chlamydospores produced in this manner correspond in dimensions and structure with those developing naturally on the host and germinate normally.

MCDONOUGH (E. S.). **Host-parasite relations of Sclerospora graminicola on species of Setaria.**—*Phytopathology*, xxviii, 11, pp. 846–852, 2 figs., 1938.

In this expanded account of the writer's studies on the mode of infection of *Setaria italica* and *S. viridis* by *Sclerospora graminicola*, a preliminary note on which has already appeared [*R.A.M.*, xvi, p. 527], it is stated that infected seedlings were found with the coleorrhiza just emerging and the natural entrance of the fungus is thought to occur

most often through this organ. The fungus was observed to have become systemic before the mesocotyl had elongated appreciably.

GHATAK (P. N.). **Investigations on Orange rot in storage. I. Orange rot due to two strains of Fusarium moniliforme Sheldon.**—*J. Indian bot. Soc.*, xvii, 2–3, pp. 141–148, 1 pl., 4 figs., 1938.

Kamala oranges (*Citrus chrysocarpa*) sold in Calcutta markets during winter are affected by a soft rot caused by two strains of *Fusarium moniliforme* [*Gibberella fujikuroi*: *R.A.M.*, xvi, p. 656], one referred to as A1 being obtained from fruits from Darjeeling and the other, A2, from fruits from Assam. A small, semi-pliable, light brown, water-soaked area appears on the rind, subsequently enlarging and showing white patches in the centre bearing conidia; finally, the whole surface of the fruit becomes covered with a white encrustation and the orange is reduced to a pulpy mass. Oranges from Darjeeling and Assam are more liable to this condition than those from Nagpur, which are only very slightly affected. The two strains (distinguished chiefly because of differences in pathogenicity) have similar morphological characters, but mycelial growth is more vigorous in A1 than in A2. Inoculation tests showed both strains to be wound parasites. Strain A1 readily infected Assam and Darjeeling oranges and in some cases Nagpur oranges, whereas A2 infected only Assam oranges vigorously, was less virulent on Darjeeling, and was almost unable to infect Nagpur fruits.

ULLSTRUP (A. J.). **Variability of Glomerella gossypii.**—*Phytopathology*, xxviii, 11, pp. 787–798, 4 figs., 1938.

Variations in the cultural characters of *Glomerella gossypii* on potato-dextrose agar were observed on initial isolation from diseased cotton tissues [*R.A.M.*, xvii, p. 392] from South Carolina, Virginia, and Georgia, suggesting the occurrence of such variant types in nature. During the course of the investigations all the cultures gave rise to at least one variant. The majority of the aberrant forms fell into two fairly well-marked classes on the basis of their growth habits, the larger characterized by a dense, white, cottony aerial mycelium and the other consisting of cultures forming sparse, buff-coloured colonies. All but one of the original cultures were highly pathogenic to cotton seedlings, whereas some of the variants were only slightly virulent. A low degree of virulence was found to be directly correlated with a slow growth rate of the culture. Cytological observations disclosed a uninucleate condition of the conidia and hyphal cells, which, in conjunction with the characteristic type of variation, indicates that the changes in cultural reactions and pathogenicity are probably due to mutation in the heritable nuclear material. From a practical point of view such modifications appear to be of little importance.

ROGERS (C. H.). **Growth of Phymatotrichum omnivorum in solutions with varying amounts of certain mineral elements.**—*Amer. J. Bot.*, xxv, 8, pp. 621–624, 1938.

Following preliminary field experiments, begun in Texas in 1934, on the reaction of *Phymatotrichum omnivorum* [*R.A.M.*, xviii, p. 24] to certain mineral elements, the fungus was grown in the laboratory in

synthetic culture solutions containing starch and sucrose to which were added the elements in concentrations of from 0·2 to 500 p.p.m., and the dry weights of the mycelium were determined, after 15 to 30 days' growth. The initial growth of *P. omnivorum* in flasks containing copper (as cupric sulphate) at 5, 10, and 25 p.p.m., and in those containing 50 p.p.m. of iron (ferrous sulphate) and mercury (mercuric chloride) was very slow but became more rapid as the growth period extended. In another set of experiments the growth of the fungus was inhibited at concentrations of copper above 10 p.p.m. After 15 days there was a perceptible stimulation in the growth of the fungus in flasks containing low concentrations (1 p.p.m.) of copper, iron, manganese (manganese sulphate), and all concentrations of zinc (zinc sulphate) tested up to and including 200 p.p.m.; after 30 days there was stimulation of growth from all concentrations of manganese from 1 up to 500 p.p.m. and from aluminium (aluminium sulphate) at 10 and 50 p.p.m. In the higher concentrations of iron, both fungus and medium assumed an iron-grey colour during the later stages of growth, and in the highest concentrations of boron at which the fungus grew (200 p.p.m.), the cells of individual hyphae were distorted. At concentrations of manganese of 200 to 500 p.p.m. the mycelium spread over the entire surface of the medium and later broke up into a number of very compact and dense mats, which at 200 p.p.m. reunited again or at 500 p.p.m. remained distinct, few or no sclerotia being produced. The addition of starch to a medium resulted in ten times more growth of the fungus than in a non-starchy medium. No growth was obtained after three weeks in a non-starchy medium containing concentrations of copper at and above 1 p.p.m. It is evident from the results of these experiments that copper in the form of cupric sulphate was the most toxic of the elements tested, mercury as mercuric chloride coming second.

Kesteven (H. L.). **Dermatitis eutorulosa, with a description of the causative fungus.**—*Med. J. Aust.*, N.S., i, 23, pp. 963–967, 4 figs., 1938.

A diagnosis [in English only] is given of *Eutorula excorians* n.sp., which has been definitely shown by the results of carefully controlled pathogenicity tests, fulfilling Koch's postulates, to be the agent in Australia of a localized papulo-vesicular dermatitis with or without excoriation and weeping inflammation, 13 cases of which (all in adults) are briefly described.

The thin-walled cells average 8 to 10 μ in diameter, with a range from 2 to 12 μ. A careful search failed to reveal any trace of spore formation. Simple binary fission is usually effected by the budding-off of a cell 2 μ in diameter, but equatorial and equal division is not uncommon, and the intermediate stages of subequal fission may also be observed. The organism grows freely on Sabouraud's glucose and maltose peptone agars and other media, forming nearly circular, smooth, shining, pure white colonies, reminiscent of the polished surface of ivory; faint radial and concentric striations may be present. The cultures emit a slight odour suggestive of fermenting hops. Dextrin was rapidly fermented, followed by glucose, mannite, and sucrose. Gelatine was slowly liquefied. *E. excorians* differs from the nearly related *E. bernasconi* Fontoy-

nont and Boucher (*Ann. Derm. Syph., Paris*, xi, p. 318, 1923) in the paucity of piriform cells, absence of short filaments, and delicate membrane.

STEVENIN (G.). **Étude sur les teignes animales.** [A study of animal ringworms.]—Thèse Ec. nat. vét. Alfort, 140 pp., 1938.

This is a very comprehensive and fully documented survey of the etiology, symptomatology, and therapy of animal ringworms of fungal origin, the term 'animal' being here understood as covering those species of *Trichophyton*, *Microsporon*, and other genera which primarily attack live-stock but are readily transmissible to man [cf. *R.A.M.*, xvii, p. 175 *et passim*].

CATANEI (A.). **L'allergie teigneuse chez le Cobaye et les variations des leucocytes dans la teigne expérimentale.** [Ringworm allergy in the Guinea-pig and the variations of the leucocytes in experimental ringworm.]—*Arch. Inst. Pasteur Algér.*, xvi, 1, pp. 21–25, 1938.

Details are given of the variations in the numbers of leucocytes counted in the blood of guinea-pigs during the allergic period following experimental inoculation and reinoculation with *Ctenomyces mentagrophytes* (*Trichophyton asteroides*) [*T. mentagrophytes*: *R.A.M.*, xvii, pp. 38, 746, 818]. Polynucleosis generally begins on the fifth to the eighth day and may persist up to the fourth week after the original inoculation, reaching a maximum during the third. The increase in the leucocyte count rarely falls below 10 per cent., usually ranging from 10 to 20 or 20 to 30 (33 in one instance). Reinoculation after periods ranging from a fortnight to two months resulted in a rapid increase of leucocytes from the second day onwards, followed by a decrease, usually abrupt, to normal.

CATANEI (A.). **La flore parasitaire des mycoses de l'homme en Algérie.** [The parasitic flora of human mycoses in Algeria.]—*Arch. Inst. Pasteur Algér.*, xvi, 1, pp. 18–20, 1938.

The three main types of ringworm, trichophytosis, favus, and microsporosis, are stated to be very variably distributed in Algeria according to ethnological and geographical factors. *Trichophyton glabrum* and *T. violaceum* [*R.A.M.*, xviii, p. 110] are the chief agents of infection among the Mohammedan natives and Jewish children. European children are also liable to attack especially by these two species, but may contract ringworm from a number of other sources as well. In addition to *T. glabrum* and *T. violaceum*, the following species occur (in order of frequency): *T. acuminatum* [ibid., xvii, p. 680], *T. crateriforme* (common in Spanish and Italian settlements, respectively), *T. fumatum* [ibid., xvi, p. 317], *T. soudanense*, and *T. pervesi* [ibid., xvi, p. 746]. The following have each been recorded once: *T. regulare* [ibid., xvi, p. 458], *T. cerebriforme*, *T. sulphureum* [ibid., xiv, p. 102], *T. plicatile* [ibid., xviii, p. 27], *T. polygonum*, and *T. umbilicatum* [ibid., xvi, p. 317] Favus appears to be exclusively associated with *Achorion schoenleini*. *Microsporon audouini* has been detected only twice (once in a subject contaminated in France) [ibid., xvii, p. 680]. *M. felineum* is encountered sporadically, and *M.* [*Achorion*] *quinckeanum* [ibid., xvii, p. 593] has

twice been isolated from ringworm cases. Kerions of the scalp have yielded *Ctenomyces* [*T.*] *mentagrophytes* and *T. luxurians*.

The following organisms have been isolated from the 18 cases of mycetoma examined since the first observation of the disease in Algeria in 1892: *Nocardia* [*Actinomyces*] *madurae* (12 times), *Scedosporium apiospermum* [ibid., xv, p. 20] (twice), *Madurella mycetomi* [ibid., xv, p. 804] (once), *Glenospora clapieri* [ibid., vi, p. 727] (once), *Acremonium* [or *Cephalosporium*] *potroni* [ibid., xvii, p. 179] (once), and *Allescheria boydii* [cf. ibid., xiii, p. 512] (once).

Cutaneous blastomycosis of the forearm, due to *Cryptococcus* [*Candida*] *montpellieri* [ibid., xiv, p. 168], has been observed once. A typical case of thrush yielded *Monilia* [*C.*] *albicans*, and a case of glossitis ('hairy and granular tongue') was caused by *M.* [*C.*] *paratropicalis*. Sporotrichosis due to *Rhinocladium* [*Sporotrichum*] *beurmanni* [ibid., xvii, pp. 112, 242] occurred twice. Verrucose dermatitis (*Hormodendrum algeriensis*) [*H. pedrosoi*: ibid., xvii, p. 747] and inguinal tumours caused by *Blastodendrion* (*Enantiothamnus*) *braulti* [ibid., xiv, p. 383: cf. ibid., xviii, p. 27] have also been recorded.

Memmesheimer (A. M.). **Über einen neuen Nährboden fur Pilzkulturen.** [On a new nutrient medium for fungus cultures.]—*Klin. Wschr.*, xvii, 2, pp. 56–57, 1938.

A medium consisting of 1,000 c.c. of filtrate of 75 to 80 gm. guinea-pig skin boiled for 30 to 45 minutes in 20 c.c. 30 per cent. potash lye and 75 c.c. tap water, 40 gm. maltose, and 18 gm. agar is stated to have proved extremely valuable for the culture of *Epidermophyton* Kaufmann-Wolf, *E.* [*Trichophyton*] *rubrum*, *Microsporon audouini*, *M. felineum*, *Achorion schoenleini*, *A. quinckeanum*, *T. gypseum*, and *T. rosaceum*. Directions are given for the preparation of a dried powder from the filtrate which may be stored and used from time to time as required.

Carol (W. L. L.), Cremer (G.), Van Haren (H. B.), & Bloemen (J. J.). **Ein Fall von Mycotorulosis generalisata.** [A case of generalized mycotorulosis.]—*Arch. Derm. Syph., Berl.*, clxxviii, 2, pp. 177–187, 6 figs., 1938.

Full clinical details are given of a case of chronic generalized mycotorulosis in a 17-year-old girl in Holland. Pure cultures on Sabouraud's agar from the diseased tissues yielded a fungus identified at the Centraalbureau voor Schimmelcultures as *Mycotorula* [*Candida*] *albicans*, [*R.A.M.*, xviii, p. 27], the taxonomy of which in relation to *Candida* and other allied genera, is discussed at some length. The organism is considered to be definitely implicated as the agent of the disorder, which corresponded in practically all particulars with Kyrle's disease as described by Bloch in *Iconogr. derm. syph. urol., Kyoto*, i, 1932.

Aberastury (M.). **Onicomicosis generalizada.** [Generalized onychomycosis.]—*Sem. méd., B. Aires*, xlv, 2317, pp. 1316–1318, 2 figs., 1938.

Fungal pathogens of the nails in the Argentine include various species of *Epidermophyton* and *Trichophyton* and yeasts, chiefly *Monilia* [*Candida*] *albicans* [see preceding abstract], a generalized case of which,

involving the fingers and toes of a 21-year-old woman, is described, chiefly from the standpoint of clinical manifestations and therapy.

BERBERIAN (D. A.). **Mycologic technic for the study of anascosporous yeast-like fungi.** —*Arch. Derm. Syph., Chicago*, xxxviii, 4, pp. 526–534, 3 figs., 1938.

The technique employed by the writer at Beirut, Syria, for the study of anascosporous, filamenting, yeast-like fungi associated with human disease, e.g., *Monilia* [*Candida*] *albicans*, is described.

WHALEN (E. J.). **Fungous infections of the external ear.**—*J. Amer. med. Ass.*, cxi, 6, pp. 502–504, 1938.

The relative frequency of the pathogenic fungi associated with otomycosis varies in different parts of the world, *Aspergillus* predominating in China [*R.A.M.*, xiv, p. 633] and in the temperate zone of the Americas, while *Monilia* [*Candida*] is more prevalent in the Canal Zone. Other genera represented in infections of the aural canal include *Penicillium*, *Achorion*, and *Mucor*. The present paper deals chiefly with the therapeutic treatment of the disorder.

STEWART (R. A.) & MEYER (K. F.). **Studies in the metabolism of Coccidioides immitis (Stiles).**—*J. infect. Dis.*, lxiii, 2, pp. 196–205, 2 graphs, 1938.

A detailed, tabulated account is given of the writers' studies on the metabolism of *Coccidioides immitis* [*R.A.M.*, xviii, p. 29] which was shown to present no significant differences in either a protein-rich (veal infusion broth) or synthetic medium. Contrary to statements in the relevant literature, glucose was assimilated both by *C. immitis* and *Blastomyces* [*Endomyces*] *dermatitidis* [loc. cit.] on synthetic media. The resistance of *C. immitis* to desiccation may be an important factor in the dissemination of the organism in the dry, warm climate of the San Joaquin Valley, California [see next abstracts], where environmental conditions favour the development of the chlamydospores which are apparently essential for animal infection.

DICKSON (E. C.). **Coccidioidomycosis: the preliminary acute infection with fungus Coccidioides.**—*J. Amer. med. Ass.*, cxi, 15, pp. 1362–1365, 1938.

Further clinical details are given of the preliminary acute phase of infection by *Coccidioides* [*immitis*: see preceding abstract] in man and animals in the San Joaquin Valley of California [*R.A.M.*, xvii, p. 112], which can now be definitely attributed to the inhalation of chlamydospores with dust. Erythema nodosum is a very frequent, but not a constant, concomitant of this early stage of coccidioidomycosis, recovery from which is usual, though the subsequent development of the semi-chronic granulomatous form of the disease, with a mortality rate of 50 per cent., is by no means excluded.

DICKSON (E. C.) & GIFFORD (M. A.). **Coccidioides infection (coccidioidomycosis). II. The primary type of infection.**—*Arch. intern. Med.*, lxii, 5, pp. 853–871, 6 figs., 1 graph, 1938.

This is a comprehensive discussion, supplemented by eight case reports, of the clinical aspects of the primary type of infection by

Coccidioides immitis [see preceding abstracts], of which a total of 354 cases (139 males and 215 females) was reported in the San Joaquin Valley, California, during the period from 1st January, 1936 to 15th May, 1937. The term 'coccidioidomycosis' is suggested to include all types and phases of the disease, individual cases being classified as due to primary coccidioidomycosis and progressive (secondary) or granulomatous coccidioidomycosis.

MÜLHENS (K. J.). **Beobachtungen an drei Cephalosporienstämmen, die aus menschlichem Blut und Harn gezüchtet wurden.** [Observations on three strains of *Cephalosporium* cultured from human blood and urine.]—*Zbl. Bakt.*, Abt. 1 (Orig.), cxlii, 3-4, pp. 160–165, 2 figs., 1938.

Three strains of *Cephalosporium* were isolated from the blood and urine of a girl suffering from septicæmia at the Bonn (Germany) Children's Hospital [*R.A.M.*, xv, pp. 219, 501]. Although the results of inoculation experiments on guinea-pigs, mice, and a human subject did not denote virulent pathogenicity on the part of the strains, the fungus is thought to be probably more important as a source of embolic contamination than is generally supposed.

KNOWLES (N. R.) & CLERKIN (P.). **Investigation of an instance of mould infection in sealed eggs.**—*J. Minist. Agric. N. Ire.*, vi, pp. 63–68, 1938.

Eggs preserved at a factory in Northern Ireland, though outwardly normal, developed an average spoilage of 12½ per cent. (the loss in some instances reaching 60 per cent.) as a result of mould growth [cf. *R.A.M.*, xvii, p. 794] in the air-space and less often on the shell in the white. The air-space moulds were all due to species of *Penicillium*, while the others, enclosed in gelatinous knobs, were due to *Sporotrichum*, many strains being identified as *S. carnis* [ibid., xiii, p. 442]. Eggs infected with either type of mould had a musty flavour. Infection was also accompanied by a high proportion of sour and black-rotted eggs, these conditions resulting from bacterial invasion.

It was considered that entry was in all probability due to two factors in processing, viz., (*a*) alternate warming and cooling, which resulted in expansion and contraction of the air-space, and (*b*) more probably the forcing-in of organisms on the surface of the eggs by the entrance of wax through the pores during sealing under reduced pressure. Contamination appeared to have occurred in the factory, before or during pre-heating.

Inspection of the buildings revealed the presence of dampness, the existence of dusty lofts with damp patches over the testing and pre-warming rooms, and dilapidations. The number of mould (*P.* spp.) spores falling per hour per sq. ft. in the different rooms ranged from 35 to 168. The control recommendations made were as follows. All walls and ceilings were to be disinfected and lined with tin, iron, or cement. The ventilation of every room was to be made directly to the outside air, the ventilators projecting several feet above roof-level, and the air required during drying to be drawn from outside. All wooden beams, pillars, and rafters were to be enclosed in sheet iron or cement. The insulating material (cork chips) above the pre-heating room was to be

removed, and after each of these operations all the rooms were to be thoroughly disinfected. Further, at equal intervals, and before sealing the eggs, all the rooms were to be fumigated by the Maine process, using 1 part potassium permanganate and 2 parts formalin (40 per cent.). In addition, all floor surfaces were washed daily with formalin solution. After these measures had been in force for rather less than six months, infection by *Penicillium* was reduced to approximately 1 per cent.

Bose (R. D.) & Misra (S. D.). **Studies in Indian fibre plants, No. 6. Phyllody and some other abnormalities in the flower of Sunn-Hemp.** —*Indian J. agric. Sci.*, viii, 4, pp. 417–423, 2 pl., 1938.

A description is given of twelve types of phyllody observed in from 0·05 to 6·61 per cent. of seven strains of sunn-hemp (*Crotalaria juncea*) at Pusa, involving the transformation of some or all the floral whorls into greenish leaf-like structures and causing complete sterility of the plant. Other abnormalities associated with the phylloid condition include proliferation of parts, adherence of vegetative shoots formed by the converted stamen and carpel, and fasciation. Transmission of the disorder was successfully accomplished in five weeks in 14 out of 20 grafted plants (normal scions on phylloid stocks and reciprocally), the plants being covered with muslin bags. The remaining 6 grafts were damaged. These results are considered to suggest the implication of a virus in the etiology of the disease [cf. *R.A.M.*, xvii, p. 555].

[The occurrence of a similar disturbance in *C. striata* [*C. saltiana*] at Bombay is described by R. E. Cooper in *J. Univ. Bombay*, vi, 5, pp. 57–61, 1 pl., 1 fig., 1938.]

Doran (W. [L.]). **Germination of seeds and damping-off and growth of seedlings of ornamental plants as affected by soil treatment.**—*Bull. Mass. agric. Exp. Sta.* 351, 44 pp., 2 figs., 1938.

In search of safe and inexpensive soil fungicides for the control of the post-emergence damping-off of seedlings, caused by *Rhizoctonia solani* and two species of *Pythium* [unspecified], the author conducted a series of trials [some of the results of which have already been noted from other sources: *R.A.M.*, xvi, p. 659; xvii, p. 502] with seeds or cuttings from 112 different species of ornamental plants and vegetables [listed in the appendix], grown in artificially infected autoclaved soil or in naturally infected soil. In the light of the author's own and other workers' investigations damping-off appears not to be controllable by the adjustment of soil temperature, moisture, and reaction, the environmental conditions favourable to plants being also propitious to fungi. Generally a soil treatment, favourable to some plants, was not so good or even injurious for others; thus charcoal, which is not considered to be a fungicide, significantly improved the growth of nasturtium (*Tropaeolum majus*), but had no such effect on *Aubrietia*, heliotrope (*Heliotropium peruvianum*), or sweet pea, while calcium sulphate favourably affected sweet pea only. Damping-off was not controlled by calcium sulphate, acetate, or chloride, or by raising the hydrogen-ion concentrations of soil with hydrated lime, but it was satisfactorily combated by calcium cyanamide and ammonium hydroxide, which latter did not injure the germination of most species, while ammonium acetate was less effective.

The interval between soil treatment and seeding depends to some extent on the strength of the toxic effect of the fungicide on the plant, and partly on the species of plant involved; in general, formic acid, formaldehyde, acetic acid (and vinegar) were less injurious to slowly germinating seeds than to those which germinated rapidly; there is a considerable delay between soil treatment and seeding in the case of calcium cyanamide. Tannic acid improved the growth of foxglove (*Digitalis purpurea*) and apparently improved the soil physically, but did not seem to exert a fungicidal effect. Less than one-fifth as much formaldehyde as was formerly used controlled damping-off when less water was applied with it. Acetic acid dusts controlled damping-off and were not injurious to most species of plants when applied to the soil the day before seeding, but were toxic to softwood cuttings.

Quantities of volatile chemicals which were not injurious when applied to the soil immediately before sowing were harmful when strewn over the surface of the soil immediately after. Acetic acid and formaldehyde injured crucifers more often than other plants. Vinegar in amounts too small to control damping-off was injurious when applied after the emergence of seedlings. Acetaldehyde was less harmful to both plants and fungi than formaldehyde and improved the growth of sweet pea, as did also ethyl alcohol. Calcium hypochlorite [ibid., xiv, p. 673] cannot be safely used in effective quantities with most species immediately before sowing, and the interval between soil treatment and sowing must be adequately prolonged. Seeds of a plant requiring three months to germinate were not well protected by acetic acid, but were by copper oxalate, indicating that seeds and seedlings of slowly germinating species of plants may be better protected by inorganic salts than by volatile chemicals. All salts of copper were injurious to many plants, hollyhock (*Althaea rosea*) showing the greatest tolerance. Species of *Dianthus* and *Rhododendron* were notably tolerant of sulphuric acid, and the former also of aluminium sulphate in quantities injurious to many other plants. No control was obtained with potassium permanganate or flowers of sulphur.

AINSWORTH (G. C.). **A note on certain viruses of the Cucumber virus 1 type isolated from monocotyledonous plants.** – *Ann. appl. Biol.*, xxv, 4, pp. 867–869, 4 figs., 1938.

The results of inoculations of tobacco and cucumber plants with virus strains isolated from mosaic-diseased lily, hyacinth, and tulip plants proved that these strains were related to cucumber virus 1 [*R.A.M.*, xvii, p. 585], the only difference being their tendency to remain localized in tobacco and cucumber, while cucumber virus 1 and most of its variants become systemic in these hosts. The tulip strain showed a similarity to strain 6, described by Price [ibid., xiv, p. 812], and a greater intensity of necrotic action than the lily or the hyacinth strains, the two latter being more similar to each other than to the tulip strain.

OBEE (D. J.). **Studies on the host range of Sclerotium delphinii Welch.** – *Trans. Kans. Acad. Sci.*, xl, pp. 89–93, 1 pl., 1938.

A list is given of 106 plants which were inoculated by the writer with *Sclerotium delphinii* [*R.A.M.*, xvii, pp. 557, 763, and above, p. 153]

from *Ajuga reptans*, mycelium from potato dextrose agar cultures being introduced into the soil round the roots of potted plants in the greenhouse. Among the 77 infected and subsequently killed by the fungus were hollyhock, *Anchusa capensis*, *Aquilegia canadensis*, begonia, *Calceolaria*, *Campanula persicifolia*, wallflower, *Chrysanthemum maximum*, dahlia, *Digitalis purpurea*, *Gypsophila* spp., *Impatiens balsamina*, *Lavendula spica*, lupins, *Narcissus tazetta*, poppies (*Papaver orientale* and *P. nudicaule*), *Petunia hybrida*, *Primula*, *Portulaca grandiflora*, *Rosmarinus officinalis*, *Viola* spp., *Ricinus communis*, potato, tomato, celery, and cauliflower. It is apparent from these data that the potential host range of *S. delphinii* is almost as wide as that of the closely related *S. rolfsii* [ibid., xvii, p. 750]. The symptoms caused by both fungi are practically identical.

Buddin (W.). **Root rot, shoot rot, and shanking of Tulip caused by Phytophthora cryptogea Pethybr. & Laff. and P. erythroseptica Pethybr.**—*Ann. appl. Biol.*, xxv, 4, pp. 705–729, 8 figs., 1938.

Phytophthora cryptogea and *P. erythroseptica* have been isolated from numerous specimens of forced tulips from nurseries in Hampshire, Middlesex, Lancashire, Scotland, and other parts of Great Britain, suffering from a serious disease, formerly known under the name of 'shanking' [*R.A.M.*, xvi, p. 615], though rotting of the root and shoot are also characteristic symptoms. The disease may cause great losses, houses containing 30,000 forced bulbs not infrequently failing to produce a single flower. It was first recorded in 1928 [ibid., ix, p. 594] and has not yet been reported elsewhere, though it appears to be widely distributed in Great Britain.

Repeated reisolations, a comparison of the isolates in pure culture with authentic strains, and comparative inoculation and soil contamination experiments proved the two species to be, either separately or in conjunction, the cause of the disease. Soil contamination experiments with *P. cryptogea* var. *richardiae* and *P. parasitica* gave negative results. The infection spreads from contaminated soil into the roots, which begin to be attacked as soon as the first roots are produced, and then passes through the basal plate of the bulb to the base of the flowering stem, practically without affecting the old bulb scales. The infected bulbs produce either no shoots at all, or shoots bearing blind flower buds owing to the flower stems being rotted at the base, or they may produce a flower of very poor quality. A very similar disease was induced in outdoor tulips by inoculation of the soil with either fungus, and it is thought that the disease may have been overlooked out of doors because the symptoms are less severe and liable to be confused with those of plants suffering from basal plate damage, injuries from careless hoeing, or from attacks of mice or slugs. The disease is believed to be mainly carried in contaminated soil, a contaminated water-supply being a possible but relatively unimportant factor, while there is no evidence that it is transmitted with the bulb, the spread of infection from one or more inoculated bulbs planted in the midst of healthy ones in the glasshouse being comparatively slow. Of the tulip varieties used in this study, William Pitt and William Copland of the Darwin type are highly susceptible, Rose Copland and Bartigon are freely attacked,

Pride of Haarlem and Madam Krelage less so, and Clara Butt is relatively resistant. Out of doors Inglescombe Yellow was very resistant. The disease has been seen in Vermilion Brilliant, White Swan, and White Hawk, and the double early variety Tea Rose is also susceptible. Steam-sterilized soil yielded 99·5 per cent. of marketable blooms, whereas the untreated contaminated soil yielded only 30 per cent.; soil treated with formaldehyde (1 part of a 38 to 40 per cent. solution to 49 of water) at least a fortnight before planting gave an average of 97 per cent. of good blooms against 30 per cent. on the untreated soil. Soil treatment with Cheshunt compound gave unsatisfactory results.

WILLIAMS (P. H.). **Investigations on the rust of Roses, Phragmidium mucronatum Fr.**—*Ann. appl. Biol.*, xxv, 4, pp. 730–741, 1938.

In this study on rose rust (*Phragmidium mucronatum*) [*R.A.M.*, xvii, p. 682] the author gives the results of investigations started at Cheshunt in 1933, progress reports on which have already been noticed from other sources [ibid., xvi, p. 726]. On the basis of inoculation tests on the rose, *Rosa laxa*, Kokulensky's *canina*, Deegen's *canina*, Schmidt's Special, and *R. canina*, the author classifies the strains of the rust into five groups: (1) strains A and E, both from *R. canina*, infecting all the test hosts except Kokulensky's *canina* and rose (subinfection with E), and in the case of A, Schmidt's Special; (2) B, H, and K from *R. laxa*, Kokulensky's *canina*, and Deegen's *canina*, respectively, infecting all hosts except rose, which showed lesions but no spots; (3) F from *R. laxa*, infecting all except Kokulensky's *canina* and Schmidt's Special; (4) C and G from rose, infecting only the rose and Schmidt's Special, and (5) D from *R. rugosa*, infecting rose but not *R. laxa*, the only hosts tested. From these results the author concludes that cross-infection between briars of the *R. canina* and *R. laxa* groups and the cultivated roses does not take place to any extent. The strains from *R. laxa* and *R. canina* were found to resemble each other closely in the size of the teleutospores, while the average size of those from the cultivated rose strains was somewhat larger. The teleutospores of *P. mucronatum* require a period of rest and exposure to winter conditions for proper ripening and germination. The mycelium is capable of persisting for several years in the stem, but no evidence of systemic infection was found.

JONES (L. H.). **Relation of soil temperature to chlorosis of Gardenia.**—*J. agric. Res.*, lvii, 8, pp. 611–621, 2 figs., 1938.

The results of experiments carried out in a constant soil-temperature apparatus, at the Massachusetts Agricultural Experiment Station, showed that a chlorotic condition of *Gardenia veitchii* grown under glass, which is stated to have caused serious concern to Massachusetts growers during two previous winters, was consistently induced at soil temperatures of 18° C. or lower, the intensity of the trouble being directly related to decreasing temperature. Traces of chlorosis also appeared at soil temperatures of 20° and 22°, but did not increase in intensity as time went on, and the condition did not develop at higher soil temperatures, independently of the ambient air temperature. Changes in the

length of daylight did not affect the onset of the trouble. It was further found that when the soil temperatures were lowered, hard plants grown at medium soil temperatures developed chlorosis more slowly than soft plants grown at high temperatures. A sharp rise in soil temperature maintained for 13 days was sufficient to start a gradual return of the healthy green colour of the leaves. At soil temperatures as low as 10° and 8° chlorosis only developed in plants that had previously been growing slowly, while plants grown rapidly at high soil temperatures developed a very dark green colour when the temperature was lowered and ceased to grow but set a great profusion of flower buds. There was an inverse correlation between the rate of growth and the intensity of the development of chlorosis.

Schopfer (W. H.) & Blumer (S.). **Untersuchungen über die Biologie von Ustilago violacea (Pers.) Fuck. II. Mitteilung : Wirkung des Aneurins und anderer Wuchsstoffe vitaminischer Natur.** [Studies on the biology of *Ustilago violacea* (Pers.) Fuck. Note II: Effect of aneurin and other auxins of the nature of vitamins.]—*Arch. Mikrobiol.*, ix, 3, pp. 305–367, 2 figs., 13 graphs, 1938.

Continuing their studies (with the collaboration of V. Kocher) on the effect of aneurin and other growth-promoting substances on the biology of *Ustilago violacea* [*R.A.M.*, xvii, p. 247], the writers found that the development of the smut was stimulated not only by aneurin itself, but by all natural plant and animal materials containing the auxin, as well as by extracts of auxo-heterotrophic fungi grown in pure culture with the addition of aneurin or one of its components, pyrimidin and thiazol. The auxin exercises its optimal effects on *U. violacea* at very minute doses compared with those required by other micro-organisms dependent on its presence.

Further details are given concerning the utilization by *U. violacea* of various sources of carbon and nitrogen. The smut made fairly good growth in the refrigerator at 1° C., a fact that may explain the capacity of the sporidia to overwinter in the soil; the optimum temperature appears to be about 22·5°, and the maximum below 28°.

A preliminary note on comparative studies of the growth requirements of ten *U.* spp., here described in greater detail, has already been noticed from another source [ibid., xvii, p. 618].

It is concluded, as a result of these investigations, that *U. violacea* requires for its development the entire aneurin molecule, which can be partially synthesized from pyrimidin and thiazol. Presumably the auxin produces its beneficial effects through the carbohydrate metabolism of the fungus.

Castellani (E.). **Helminthosporium nodulosum Sacc. sul 'Dagussà' in Eritrea.** [*Helminthosporium nodulosum* Sacc. on 'Dagussà' in Eritrea.]—*Agricoltura colon.*, xxxii, 10, pp. 447–451, 2 figs., 1938.

Eleusine coracana plants in Eritrea have frequently been observed to show a spotting of the leaves, and sometimes of the culm and inflorescences [the symptoms of which are described in detail], due to *Helminthosporium nodulosum* [*R.A.M.*, xv, p. 426]. On Eritrean

material the conidiophores averaged 105 by 5 μ and the 4- to 8 (generally 6) -septate conidia 48 by 10 μ.

HYDE (E. O. C.). **Detecting Pullularia infection in Rye-grass seed crops.** —*N.Z. J. Agric.*, lvii, 4, pp. 301–302, 2 figs., 1938.

The low germination commonly found in perennial rye grass [*Lolium perenne*] seed crops in New Zealand is generally due to infection of the grass kernel by a fungus classified as *Pullularia*. The disease is very difficult to detect in the field, the seeds alone being attacked, and the plants often appearing perfectly normal. Affected seed, when machine-dressed, may be of good weight and colour, dry, and devoid of mustiness, and yet be practically worthless owing to low germination resulting from extensive infection.

A method has now been devised by which it is possible to estimate the quality of the seed before harvesting. If about 80 per cent. of the seed is found to be infected, the crop is not worth cutting, but a farmer forewarned in this way is saved the loss involved in harvesting and machine-dressing seed with a very low germinating capacity. The procedure is simple, but must be carried out with care. A few seed-heads are collected from scattered parts of the field, and a few spikelets from scattered positions on each seed-head are removed in the laboratory, each seed being examined microscopically. Infected seeds can be distinguished by the presence of a sticky fluid containing the conidiophores. If the seed is dry, the secretion may have become solid, in which event it is of a waxy consistency, and either clear or pale pink. When rain or dew has washed away the spores, infection is apparent in the dull, rusty-red colour of the grain, which is opaque and appears dark when examined with a diaphanoscope.

Examinations of one area of rye grass at 7- to 10-day intervals gave 10, 28, 44, and 56 per cent. infected seed, the germinating capacity of the crop being 37 per cent.

THURSTON (H. W.) & MILLER (H. J.). **Experiments with liquid lime sulphur for spraying Apples.** — *Phytopathology*, xxviii, 11, pp. 823–832, 1938.

A tabulated account is given of tests conducted in 1937 on 20-year-old Stayman apples in an orchard in Adams County, Pennsylvania, of various lime-sulphur treatments for the control of scab [*Venturia inaequalis*] with a view to the development of a spray programme providing a better balance between scab control and spray injury than that afforded by the standard schedule. The lime-sulphur was applied either by a small or big gun at concentrations of 1 in 50, 1 in 75, 1 in 100, and 1 in 200, with and without the addition of an amendment of hydrated lime at 5 in 100, the treatments being given on 17th April, 3rd and 19th May, 1st, 11th to 12th, and 23rd June, and 16th to 18th July.

The incidence of scab was found to increase progressively with the dilution of lime-sulphur from an average of 2·9 per cent. scabbed fruit at 1 in 50 to 18·1 per cent. at 1 in 200, the control yielding 86 per cent. There was a decrease in foliar injury from 23·1 to 15·3 per cent. with increased dilutions up to 1 in 100 with a renewed sharp rise (43·5 per cent. at 1 in 200). On an average the big gun caused more damage to the

leaves (26·4 per cent.) than the small one (21·8) and reduced the yield from 13 to 11·6 bush. per tree, but gave nearly 5 per cent. better scab control (7·06 as compared with 12·20 per cent.). The addition of lime to the spray reduced foliar injury from 32·2 to 15·6 per cent. and increased the yield from 11·8 to 12·9 bush. per tree, but slightly favoured the development of scab (10·5 as compared with 8·6 per cent.).

All factors considered, the best combination from the joint standpoint of scab control and avoidance of leaf injury is probably the 1 in 75 dilution.

REINECKE (O. S. H.). **Little leaf of deciduous fruit trees.**—*Fmg S. Afr.*, xiii, 151, pp. 386–390, 2 figs., 1938.

On a recent overseas tour the writer observed little leaf of deciduous fruit trees in the Argentine, New Zealand, and all the Australian States except Tasmania. In Queensland the results of the zinc sulphate treatment [*R.A.M.*, xviii, p. 36] were most impressive. So far the best results under South African conditions have generally been obtained by dormant treatments with concentrated zinc sulphate. For instance, in 1936, Kieffer pears at Stellenbosch responded by a striking improvement to the application of a spray consisting of 16 lb. zinc sulphate per 100 gals. water, while a similarly favourable reaction was shown by Bon Chrétiens at Groot Drakenstein to the same treatment at 25 lb. per 100 gals.; complete recovery from die-back ensued in both cases. Good results were also secured with soil dressings of 21 lb. zinc sulphate per tree of Kieffer pears. In some parts of the Union, peaches and pears have also benefited from dormant applications of a mixture of dilute zinc sulphate and lime. The vine is also stated to be moderately susceptible to little leaf in South Africa.

PHILLIPS (W. R.). **The application of controlled atmospheres in the storage of fruits.**—*Sci. Agric.*, xix, 2, pp. 66–68, 1938.

The author states that McIntosh apples, probably the most important variety in Canada, are very liable to develop core-flush [*R.A.M.*, xvi, p. 820] and other forms of internal breakdown when stored in ordinary atmosphere at 32° F., at which their storage life is the longest. The results of research work, later confirmed by those of semi-commercial trials, showed that by keeping the apples in an atmosphere of 7 per cent. carbon dioxide and 14 per cent. oxygen at 39° their storage life could be extended by the same amount as by keeping them at 32° in ordinary atmosphere, without core-flush developing; under these conditions the apples were slightly superior in quality to those stored at 32°, and were slightly less advanced in maturity according to pressure tests. It is stressed, however, that controlled atmospheres should not be used for prolonging the normal storage life of the McIntosh apple, which should be marketed before the end of January, when its standard quality is at its highest.

DICKSON (G. H.). **Some results of mineral fertilizers on Apple seedlings.** *Sci. Agric.*, xix, 2, pp. 105–109, 2 diags., 4 graphs, 1938.

Details are given of fertilizer experiments since 1932 at the Ontario Horticultural Experiment Station, the results of which showed that the

addition of muriate of potash was definitely effective in improving the condition of the foliage of Salome seedling apples which in 1932 had exhibited severe leaf scorch due to potassium deficiency [*R.A.M.*, xvii, p. 254]. There was clear evidence, however, from mechanical and chemical analyses and examination of the soil profiles round the roots, that this deficiency may be a secondary effect, the primary cause being unfavourable soil or subsoil conditions; in such cases, the application of potassium fertilizers is merely advisable as a means of hastening the recovery of affected trees, a permanent cure only being obtainable by remedying the soil defects as soon as possible.

PRASAD (H. H.). **A note on soft rot of Pears caused by a species of Aspergillus.**—*Indian J. agric. Sci.*, viii, 4, pp. 549–551, 1 col. pl., 1938.

Extensive damage is stated to be caused among pears exposed for sale in Delhi market from July to November by a species of *Aspergillus* closely resembling *A. japonicus* [*R.A.M.*, xvii, p. 796], which produces on the fruits brown, water-soaked spots, $\frac{1}{4}$ to 1 in. in diameter, rapidly expanding and disorganizing the tissues in four or five days. Positive results were obtained in inoculation experiments through needle punctures with fragments of agar cultures. The fungus grows profusely on various solid media at a P_H range from 3·3 to 8.

CHRISTOFF (A.). **Virus diseases of the genus Prunus in Bulgaria.**—*Phytopath. Z.*, xi, 4, pp. 360–422, 11 pl., 1938.

An account is given of the classification and symptoms of virus diseases of drupaceous fruit trees in Bulgaria [*R.A.M.*, xvii, p. 326], based on numerous observations in many nurseries and orchards during a period of over five years. Broad streak and ring-spot variegation, for which Atanasoff's original name of plum pox [ibid., xii, p. 229] is retained, causes the symptoms already described on plum, peach, cherry, apricot, sour cherry (*Prunus cerasus*), greengage (*P. cerasifera* and its var. *pissardi*), and sloe (*P. spinosa*), with slight variations in different fruits and even in different varieties of the same fruit. The author has not so far observed the disease on almond [cf. ibid., xiv, p. 368], the ill-defined spots occurring on this host being attributed to mosaic. Successful transmissions by budding were made from plum to greengage and apricot, from cherry to cherry and *P. mahaleb*, and from *P. mahaleb* to cherry. The symptoms appear very early on single leaves, but often become masked in cool or hot weather, and have also been observed in several orchards on plum, greengage, cherry, *P. mahaleb*, and apricot to be temporarily obscured on the foliage. The virus withstood exposure to a temperature of 59° to 60° C. for 15 minutes, but succumbed after 30 minutes, and after 15 minutes at 65° to 66°. Destruction of infected trees in an orchard in north Bulgaria in 1935 is stated to have given good results. The disease was found to be generally distributed in the south-west, especially in the Kustendil district, where more than 120,000 trees in the nurseries were eradicated.

Narrow-striped and ring spot variegation, believed to be identical with Valleau's virus disease of plum and peach [ibid., xii, p. 454], causes narrow (0·5 to 2 mm.), winding lines, crossing the veins or run-

ning parallel with them, irregular circles, or regular or irregular, light to yellowish-green, small rings on plum, cherry, almond, and greengage leaves in the north and more rarely in other parts of the country. The author has not as yet found the disease on peach. Transmission by budding was successful from plum to greengage and almonds after a maximum incubation period of ten months, but not to pear, apple, or quince. Masked infection with no leaf symptoms was present in the Kustendil plum and Japanese plum (*P. salicina*). The disease is carried over in the grafts taken from infected trees and can be observed from spring to autumn. Destruction of infected trees in 1933 in the State nursery near Loukovit proved to be a successful measure of control. A survey carried out in 1936 in the Pleven district disclosed that about 100,000 trees out of some 5,000,000 were infected, and over 51,000 diseased trees have been destroyed.

Mosaic is believed to be a group of diseases caused by several viruses, three kinds of mottling obtained experimentally being designated ordinary polygonal mosaic mottling, fine to star-like mosaic, and peripheral chlorosis. The symptoms of mosaic vary greatly on different species and also within them, appearing most commonly as fine, polygonal, clearly marked, lighter green to greenish-yellow spots or stripes on the leaves of plum, peach, cherry, apricot, almond, sour cherry, greengage, *P. mahaleb*, and sloe. Sometimes the leaves are deformed, the fruits may show dark green, watery spots, which usually disappear, and may fall prematurely. The symptoms observed on different varieties of the fruit trees mentioned are described in detail. All forms of mosaic are transmissible by budding or grafting, the incubation period lasting for 11 to 12 months. The virus was also successfully transmitted by means of contaminated juice, the incubation period in this case being only two to four months. The star-like mosaic was also transmitted by the seed in an experiment with stones from 56 greengage trees. The symptoms of mosaic appear in spring but often disappear or become disguised by a slight or pronounced chlorosis during the summer. An appended survey of literature shows that the geographical distribution of mosaic diseases of the genus *Prunus* includes Canada, ten States of the United States, South Africa, Czechoslovakia, and Holland. There is some observational and experimental evidence indicating that the mosaic and pox viruses usually manifest themselves separately, their combined action resulting in scorched spots on the leaves.

Discussing the classification of viruses adopted by K. M. Smith [ibid., xvii, p. 52], the author refers the broad-striped variegation to *Prunus* virus 7; and the narrow-striped to *Prunus* virus 7a [both new viruses: cf. K. M. Smith who lists plum pox under *Prunus* virus 5].

Christoff (A.). Кафявото гниене по овощнитѣ дървета въ България. [The brown rot of fruit trees in Bulgaria.]—*J. agric. Exp. Stas Bulgaria*, viii, 3, pp. 3–32, 6 figs., 1938. [English summary.]

The results of numerous observations and the study of many specimens from all parts of Bulgaria showed the presence in the country of four species of *Sclerotinia* on fruit trees. *S. cydoniae* on quince [*R.A.M.*, xii, p. 488] and *S. mespili* on medlar [ibid., xv, p. 703] have only a restricted distribution, and inoculation experiments with the former on

apple, plum, and nectarine were unsuccessful. *S. fructigena* [ibid., xvii, p. 687] is widely distributed throughout the country on both stone and pome fruits, causing chiefly fruit rot and sometimes canker. *S. laxa* [ibid., xviii, p. 120] causes chiefly fruit rot on pome and stone fruits, but wither tip, spur blight, blossom wilt, twig blight, canker, and wilting of the shoots of stools and layers in nursery beds occur only rarely and under such favourable conditions of high moisture as obtain in districts along the Black Sea coast and some of the rivers.

Cultural studies and inoculation experiments with numerous isolations of *S. laxa* from pome and stone fruits, taken from all parts of the plant, indicated the existence of many sub-races, falling into two groups, which seem to be identical with Ezekiel's S_{44} [Wormald's strain of *S. cinerea* f. *pruni* = *S. laxa*] and S_{47} [Californian strain agreeing with Wormald's *S. cinerea* = *S. laxa*] [ibid., v, p. 108]. Cross-inoculations of apple flowers with isolations from plum fruits and of plum flowers with isolations from wilted apple blossoms or fruits gave positive results in each case, and the separation into biological forms *pruni* [*S. laxa*] and *mali* [ibid., xiii, p. 33; xiv, p. 367] is, therefore, believed to be unjustified. By germination tests with spores from numerous specimens of different fruits it was established that *S. fructicola* [ibid., xviii, p. 120] does not occur in Bulgaria.

HENRICK (J. O.). **Leaf rust of stone fruits. Puccinia pruni-spinosae (Pers.).**—*Tasm. J. Agric.*, N.S., ix, 4, pp. 199–201, 1 fig., 1938.

Nectarines and early peaches in the vicinity of the Tamar valley and Hobart, Tasmania, have recently been affected by leaf rust (*Puccinia pruni-spinosae*) [*R.A.M.*, xvii, p. 756]. Observations indicate that the disease may possibly become a serious factor in Tasmania in peach, nectarine, apricot, and plum areas. It is recommended that spraying should be carried out with lime-sulphur (1 in 60) after picking, that all fallen leaves should be ploughed or hoed in during the late autumn, winter, or after pruning, that all peach and nectarine prunings should be burnt, and that spraying with lime-sulphur (1 in 10) or Bordeaux mixture (6–4–40) should be effected in the late dormant period or at the first sign of bud movement; anemones showing yellowing, dwarfing, or twisting should be removed and burnt.

HUBER (G. A.) & SCHWARTZE (C. D.). **Resistance in the Red Raspberry to the mosaic vector Amphorophora rubi Kalt.**—*J. agric. Res.*, lvii, 8, pp. 623–633, 2 figs., 1938.

The authors state that in the course of their studies on the inheritance in raspberry varieties and hybrids of resistance to raspberry mosaic [*R.A.M.*, xvi, p. 518; xvii, p. 377] they observed that *Amphorophora rubi* [ibid., xvi, p. 194], the most important aphid vector of the disease in western Washington, was more abundant on some varieties than on others, and was absent from the variety Lloyd George. The work described in this paper was therefore carried out to determine the practicability of solving the raspberry mosaic problem by breeding for resistance to the aphid in regions where the latter is the principal distributor of infection. The results of greenhouse experiments and field observations showed that aphid resistance was inherited and trans-

mitted when a resistant variety was crossed with a susceptible one. The variety Lloyd George was found to be heterozygous for resistance, and so far no homozygous parent has been found.

DAVIS (M. B.) & BLAIR (D. S.). **The Strawberry and its cultivation in Canada.**—*Fmrs' Bull. Canad. Dep. Agric.* 63, 43 pp., 27 figs. (3 col.), 1 graph, 1938.

This bulletin contains a section (pp. 38–43) by G. H. Berkeley on common strawberry diseases and their control in Canada, giving brief, popular notes on leaf spot [*Mycosphaerella fragariae*: *R.A.M.*, xvii, p. 695], leaf scorch [*Diplocarpon earliana*: ibid., xvii, p. 610], powdery mildew [*Sphaerotheca humuli*], grey mould [*Botrytis cinerea*], 'leak' [*Rhizopus nigricans*], root rot (a complex disorder associated with infection by various soil organisms [including *Ramularia*, *Fusarium*, and *Coniothyrium* spp.: ibid., xiii, p. 173 *et passim*], under the influence of a particular set of environmental factors), June yellows [or suspected mosaic: ibid., xvii, p. 377], and xanthosis [xiii, p. 314; xvi, p. 762]. Among other points of interest may be mentioned the resistance to mildew of the William Belt, Parsons Beauty, Portia, Glen Mary, and Senator Dunlap varieties, and the control of the disease in recent trials at the New York (Geneva) Agricultural Experiment Station by four applications of 85–15 lime-copper dust.

GILLESPY (T. G.). **Studies on the mould Byssochlamys fulva. Progress report.**—*Rep. Fruit Veg. Pres. Sta., Campden, 1936–37*, pp. 68–75, 1938.

Observations during the period under review confirmed previous evidence as to the inability of *Byssochlamys fulva* [*R.A.M.*, xv, p. 170] to parasitize living fruit. In the course of these investigations a number of moulds with the *Paecilomyces* type of conidiophore, closely resembling *B. fulva*, have appeared, necessitating the maintenance of all growths for a fortnight or so before definitely referring them to this species on the basis of ascus formation. The latter process may be accelerated by keeping the cultures at 22° to 28° C. instead of 37°. *Aspergillus* (?) *fumigatus* constantly developed in plantation samples of strawberries heated in the usual way, and also on processed strawberries in glass jars.

The examination of a large number of samples of gooseberries, strawberries, raspberries, loganberries, plums, and blackberries, from orchards in Gloucestershire, Worcestershire, Cambridgeshire, and Surrey disclosed an average of about 5 per cent. contamination for all four counties, gooseberries being slightly less damaged than the other fruits. Samples of strawberry leaves, flowers, and young fruits from one orchard showed no infection in late May and early June, but on 9th June, soon after straw had been laid down, 4 per cent. mould was present; the original source of the ascospores could not, however, be traced with certainty. The average degree of infection on a number of fruit samples arriving at factories and at the Research Station did not differ significantly from that of the orchard specimens. A number of bags used for the transport of gooseberries were found to be infected to the extent of 10 to 20 ascospores per sq. ft., and the mould was also detected in

similar amounts on sugar bags not hitherto used for fruit. Old gooseberry bags inspected in 1936 carried over 200 spores per sq. ft.

In aqueous suspensions of the ascospores from cultures isolated from orchard fruits by 30 minutes' heating at 80°, suspensions were kept at 2° for lengthy periods (up to 18 months) without apparent decline in numbers or loss of heat resistance. About half the ascospores used in the tests germinated in three days after heating at 55°, 60°, and 65° for ten minutes, while positive results were secured in all cases after 24 hours following ten minutes at 75° and 80°. In another series of experiments, in which suspensions were heated for ten minutes at 70°, incubated for varying periods at 37°, and re-heated at 70° for another ten minutes before plating, the germination percentages after one, two, four, and six hours' intermediate incubation in distilled water were 100 per cent. in each case, the corresponding percentages for 2 per cent. sucrose being 100, 100, 95, and 90, and for bottled plum juice 90, 1, 0, and 0, respectively. Inoculated cans of gooseberries and plums, similarly treated, showed no survival after the second heating, when the intermediate incubation period at 20° to 22° exceeded six hours. The maximum thermostability of the ascospores of *B. fulva* was found to coincide with a hydrogen-ion concentration of P_H 5, while at P_H 3 resistance is considerably greater than at neutrality.

In juices from bottles of fruit containing *B. fulva* potato disks often lost all coherence after 24 hours as a result of enzymic activity, no decrease in which could be detected in bottles after several years' storage even when the mould had died out. In contrast to bottles, tins seldom yield any evidence of the enzyme after the current year, and experiments indicated that it is no longer active in gooseberry and plum syrup after 22 and 10 weeks, respectively.

Reko (V. A.). **Die Bananenblatt-Krankheit 'Chamusco'.** [The Banana leaf disease 'chamusco'.]—*Nachr. SchädlBekämpf., Leverkusen*, xiii, 4, pp. 157–170, 13 figs., 1938.

The author gives an account of leaf spot of banana (*Cercospora musae*) as it occurs in Mexico [*R.A.M.*, xviii, p. 124], where it first appeared in 1937, causing yield losses of over 50 per cent. during the first year. The disease was successfully controlled by spraying with Bordeaux mixture (4–4–40), but several disadvantages of using this fungicide are pointed out and better results are expected from a Bayer copper spray at present being tested by the Mexican Government.

Mendez (R.). **'Sigatoka'.**—*Rev. agric. Centr. nac. Agric.*, iii, 10–12, pp. 201–207, 1 fig., 1938. [Spanish.]

In connexion with the discovery of banana leaf spot (*Cercospora musae*) [see preceding abstract] in Costa Rica, a popular account is given of the history, distribution, economic importance, and symptoms of the disease in relation to environmental factors, together with directions for its control by spraying the plants with Bordeaux mixture (5 lb. copper sulphate and 6 lb. quicklime in 50 gals. water) with the addition of 2 per cent. linseed oil, 3 per cent. coco-nut oil, or 1 per cent. whale-oil soap as an adhesive. The treatments should be applied whenever there is reason to anticipate a rainy spell or cold nights, six weeks

to two months before the expected onset in humid localities. Some data are given relating to the financial aspects of a spraying campaign, based on the experience of the United Fruit Company in Honduras, where 22 motor apparatuses are in use and perfect control is apparently obtainable by a systematic schedule of six applications, one for each month from June to November. In the writer's opinion, Costa Rican growers may have to sacrifice 50 per cent. of the profits hitherto accruing from the banana crop for the control of 'sigatoka'.

BAKER (R. E. D.). **Studies in the pathogenicity of tropical fungi. II. The occurrence of latent infections in tropical fruits.**—*Ann. Bot., Lond.*, N.S., ii, 8, pp. 919-931, 1938.

In continuation of previous studies (with C. W. Wardlaw) [*R.A.M.*, xvi, p. 395], the writer trapped a large number of fungi on aseptically prepared plates exposed in grapefruit orchards in Trinidad in 1936, including the three common storage pathogens, *Botryodiplodia theobromae* (on all six estates under observation), *Phomopsis* (*Diaporthe*) *citri* (on five), and *Colletotrichum gloeosporioides* (on four); other species present in all the orchards were *Pestalozzia leprogena* [ibid., xiii, p. 455], *Penicillium italicum*, *Trichoderma lignorum*, *Fusarium expansum*, and *Clasterosporium maydicum* [ibid., vii, p. 711]. As already noted by F. E. V. Smith [ibid., xi, p. 508] and Taubenhaus (*Proc. Tex. Citrus Inst.*, iii, p. 89, 1934), *D. citri* and *Diplodia natalensis* are present on the dead wood of citrus trees [ibid., xiv, p. 564], the removal of which reduces the incidence of rotting due to these fungi. The same observations were made in Trinidad, where dead wood also bore conidia of *Colletotrichum gloeosporioides* in relatively small numbers. As an agent of latent infection, *C. gloeosporioides* far outnumbered any of the other fungi under discussion. It attacks the young fruits severely almost as soon as they are set, and has also been isolated from the floral tissues (petals, sepals, receptacles, and stigmas). The available evidence denotes that the development of the fungus is arrested at a very early stage, infection being confined to the superficial layers of the skin. Other common organisms associated with latent infection of grapefruit are *Guignardia* sp. and *Diaporthe citri*, while some importance in this respect may also attach to *F. expansum*.

Latent infection of mangoes was found to be predominantly due to *C. gloeosporioides*, *G.* sp. and *D. citri* also being present. The fruits became infected at an early age, both through the lenticels and the intervening tissues. Other fungi obtained from surface washings of both mango and avocado pears included *Acrothecium lunatum* [*Curvularia lunata*: ibid., xvii, p. 98] (also abundant on grapefruit), *D.* (?) *citri*, *Pestalozzia leprogena*, and *Aspergillus niger* and other *A.* spp. The fungi most commonly present as latent infections of avocado were *Colletotrichum gloeosporioides*, *G.* sp., and *D.* (?) *citri*, the last-named being more common on this host than on either grapefruit or mango. *Botryosphaeria ribis* [ibid., xvi, p. 302] was occasionally detected. Infection both of the lenticels and intervening tissues takes place chiefly in the early stages of growth of the fruit. The large number of *Guignardia* isolations (166 from 33 fruits) is of some interest, since this fungus has not hitherto been recorded as a cause of avocado rot.

C. gloeosporioides and *G.* sp. were further mainly responsible for latent infection of papaw, on which *D.* (?) *citri* was also present to a smaller extent; the cultures were all obtained from fruits approaching maturity. Latent infections of both immature and ripening cacao pods yielded *C. gloeosporioides* and *D.* (?) *citri*. *Phoma destructiva* [ibid., xvii, pp. 139, 373, 418], *G.* sp., and *C. gloeosporioides* were found in green and ripening tomatoes.

Bodnár (J.) & Tankó (B.). **Versuche über die Wirkung von Kalkarsenaten auf die Schwebefähigkeit der Kupferkalkbrühe.** [Experiments on the effect of calcium arsenates on the capacity of Bordeaux mixture for remaining in suspension.]—*Neuheiten PflSch.*, xxxi, 5, pp. 199–203, 2 graphs, 1938.

The results of experiments conducted at the Debrecen (Hungary) Plant Protection Laboratory showed that calcium arsenate solutions with a poor capacity for remaining in suspension exerted a favourable effect on the suspension of the Bordeaux mixture to which they were added, while conversely, calcium arsenates with good suspensory qualities proved to be detrimental to the fungicide.

Reckendorfer (P.). **Über die Wirkungsdauer der Schwefelkalkbrühe. (Ein analytischer Beitrag zur Kenntnis ihrer Zerfallsgeschwindigkeit.)** [On the duration of the activity of lime-sulphur mixture. (An analytical contribution to the knowledge of the rapidity of its decomposition.)]—*Phytopath. Z.*, xi, 4, pp. 423–438, 1 graph, 1938.

In further experiments on the decomposition of lime-sulphur under the influence of oxygen [*R.A.M.*, xvii, p. 332] the amount of thiosulphate sulphur present was determined in 10 c.c. normal strength fungicide diluted with 30 c.c. distilled water and the results calculated as gm. per 100 c.c. of the normal fungicide. It was found that the amount of thiosulphate present increased from 1·86 gm. in the original mixture to 5·60 gm. after 7 hours of exposure to air, gradually falling to 3·20 gm. after 48 hours; the respective amounts of polysulphide and monosulphide sulphur on the other hand decreased from 11·87 gm. and 3·18 gm. to 0·37 gm. and 0·07 gm., after 7 hours. These results were further confirmed by Feigl's microchemical 'iodine acid reaction' test (Akademische Verlagsgesellschaft, Leipzig, 1931). It thus appears that the insecticide component (polysulphide sulphur) would be decomposed about 6 hours after application of the spray, whereas fungicidal activity persists for an almost unlimited period owing to the very slow oxidation of the elementary sulphur.

Beachley (K. G.). **Combining heat and formaldehyde for soil treatment.**—*Bull. Pa agric. Exp. Sta.* 348, 3 figs., 2 diags., 2 graphs, 1937. [Received December, 1938.]

A description is given of a soil sterilization apparatus for combined heat and chemical treatment, operated by a 1 h.p. engine. The formaldehyde solution used is vaporized by being pumped through generator coils heated by an oil-burner, and the vapour produced is led by way of an asbestos hose into an inverted steam-tight pan made of two layers of galvanized iron. In experiments in which pure cultures on rye grains

of an undetermined species of *Fusarium* were placed in soil at different depths, combined formaldehyde and steam was found to kill the fungus at a consistently greater depth than steam alone, the effective depth depending on the time of exposure and the concentration used. Formaldehyde in the form of vapour penetrated the soil to a greater depth than when applied as a drench. The penetration of steam vapour into silt-loam soil was shown to depend on the initial water content of the soil, and assuming that a temperature of 150° F. is essential for killing most pathogenic soil organisms it appears from the experimental data that the temperature resulting from 30 minutes' treatment would be sufficiently high to be effective at a depth of 4 in. in soil with a water content of up to approximately 16 per cent., and at a depth of 6 in. in one of up to approximately 8 per cent. water content. In experiments with 63 greenhouse flats the application of 0·097 oz. of formaldehyde solution, in the form of vapour, per sq. ft. for 15 minutes was as effective against damping-off during and after germination as the steam box method for 90 minutes, and also reduced the need for seed disinfection before planting. It was possible to plant tobacco seed and most vegetable and flower seeds 24 hours after treatment of the seed-beds with formaldehyde combined with steam. Compared with steam treatment of tobacco seed-beds by means of a 16 h.p. steam boiler, the combined formaldehyde and steam treatment gave equally satisfactory results, but the length of treatment was shortened from 30 to 20 minutes (using only 16 oz. of formaldehyde solution per 100 sq. ft.), and the cost reduced from $1 to 80 cents per 100 sq. ft.

American Type Culture Collection. Catalogue of cultures. Fourth edition. 1938.—159 pp., Washington D.C., Georgetown University School of Medicine, 1938.

This catalogue of the micro-organisms maintained by the American Type Culture Collection [*R.A.M.*, vi, p. 742], removed in 1937 to Washington, D.C., includes about 2,600 different cultures now available.

A charge of $2 plus cost of postage and packing is made for each culture, but donors may have access to any cultures deposited by them at any time, or secure others in exchange. Bacteria are dispatched 'frozen and dried', unless a test-tube culture in the active, growing state is specifically asked for. All orders and inquiries should be addressed to the American Type Culture Collection, Georgetown University School of Medicine, 3900 Reservoir Road, Washington, D.C.

Roemer (T.), Fuchs (W. H.), & Isenbeck (K.). **Die Züchtung resistenter Rassen der Kulturpflanzen.** [The breeding of resistant strains of cultivated plants.]—*Kühn-Arch.*, xlv, 427 pp., 2 col. pl., 27 figs., 10 diags., 4 graphs, 1938.

This valuable compilation of outstanding studies in the field of plant breeding for resistance to disease (in the preparation of which the authors were assisted by Dr. [R.] Freisleben, Dr. Krümmel, and Dr. [R.] Thren), is preceded by some general introductory observations and sections on the necessity of breeding for resistance, the pre-requisite biological conditions for the operations involved, the nature of resistance, the modes of its inheritance, and the practical work entailed in its

development. The individual diseases discussed are potato wart (*Synchytrium endobioticum*), potato blight (*Phytophthora infestans*), potato scab (*Actinomyces scabies*), downy and true mildews of the vine (*Plasmopara viticola* and *Uncinula necator*), apple and pear scab (*Venturia inaequalis* and *V. pirina*), bean (*Phaseolus vulgaris*) anthracnose (*Colletotrichum lindemuthianum*) and grease spot (*Phytomonas* [*Bacterium*] *medicaginis*), barley and wheat mildews (*Erysiphe graminis hordei* and *E. g. tritici*), barley stripe (*Helminthosporium gramineum*), cereal rusts (*Puccinia* spp.), including *P. glumarum* on wheat and barley, *P. triticina* on wheat, *P. graminis* on wheat, oats, and rye, *P. lolii* on oats, *P. anomala* on barley, and *P. secalina* on rye, wheat bunt (*Tilletia tritici* and *T. levis*) [*T. caries* and *T. foetens*], loose smut of wheat (*Ustilago tritici*), loose and covered smuts of barley (*U. nuda* and *U. hordei*), and oats (*U. avenae* and *U. levis* [*U. kolleri*]), maize smut (*U. zeae*), club root of cabbage (*Plasmodiophora brassicae*), stem rot of clover (*Sclerotinia trifoliorum*), cereal foot rots (*Ophiobolus graminis*, *Cercosporella herpotrichoides*, *Fusarium* spp., and *Helminthosporium sativum*), and flax wilt (*F. lini*). Most of the papers enumerated in the bibliographies at the close of each section have been noticed from time to time in this *Review*. A table is appended showing the method of infection, resistant varieties obtained by breeding, and mode of inheritance of resistance in the case of a number of well-known fungal and bacterial diseases not dealt with under separate headings.

Glennie (Agnes E.). **Index to the literature of food investigation.**—Published by Dep. sci. industr. Res., Food Invest. Board, Lond., vii, 1, xiii+371 pp., 1937; ix, 1, v+pp. 1–103, 1938; ix, 2, v+pp. 105–189, 1938; ix, 3, v+pp. 191–280, 1938; ix, 4, pp. 281–422, 1938; x, 1, v+pp. 1–94; 1938; x, 2, v+pp. 95–187, 1938.

These are further numbers of the annotated bibliography of current English and foreign publications on food research [*R.A.M.*, xv, p. 106]. In the first part of Volume x it is stated that it is hoped to complete Volume vii, no 2, and Volume viii, dealing, respectively, with works published in 1935 and 1936, in the next few months. Volume x, no. 1 deals with papers received from January to March, 1938, and in future it is intended to issue parts at quarterly intervals.

Köhler (E.). **Über eine neue, im Gewächshaus angetroffene Viruskrankheit ('Glanzkrankheit').** [On a new virus disease ('gloss disease') encountered in the greenhouse.]—*Angew. Bot.*, xx, 5, pp. 373–380, 6 figs., 1938.

In 1933, 1937, and 1938, the writer observed a hitherto undescribed disorder, herein termed 'gloss disease', of greenhouse tobacco, *Datura stramonium*, and potato plants. The leaves of severely diseased Samson tobacco showed marked epinasty, an abnormally dark green coloration, upward curling and undulation of the margins, a 'gooseflesh' roughening of the upper surface, and glossiness of the under side. The stems and leaf edges of older plants display a faint reddish-brown discoloration, accompanied by pronounced torsion of the leaf surfaces. Similar features are characteristic of diseased *D. stramonium* plants. In potatoes the symptoms of gloss disease differ according to the variety, though

glossiness of the under sides of the leaves appears to be common to all. In the case of President, the affected plants assume the stiff, broom-like habit associated with leaf roll, the leaves growing in a sharply vertical direction and the pinnae rolling inwards. The uppermost leaves of the shoot tips are usually curved over the apex; at an advanced stage the whole tip may die and shrivel (acronecrosis), or the middle and lower leaves may wither first (acropetal necrosis), while transitional forms also occur. In Erdgold all the leaves are blunted and chlorotic, the younger ones frequently with a bright gloss on the under sides. Starting from the nodes the stems and petioles assume a brown tint. Typical acronecrosis generally ensues, but in the case of a plant also containing the X virus and another resembling Y, intensive acropetal necrosis developed, i.e., the necrotic symptoms began with the lower foliage as typical 'leaf drop' [*R.A.M.*, xviii, p. 131] and proceeded upwards. In Stärkereiche [Starchy] the leaves and stems of the upper shoot region turn bronze, break and hang downwards, and shrivel. Glossiness in this variety is somewhat less accentuated.

Observations on the epidemic having suggested the implication of whiteflies (Aleurodidae) in the transmission of infection, two healthy tobacco plants were placed in contact with a diseased plant covered with these insects, with the result that the former in due course contracted the typical symptoms of 'gloss disease'. Negative results were given by experiments in the transmission of infection from diseased to healthy plants by means of the sap.

Heinze (K.). **Beseitigt die Kohlrückstände frühzeitig!** [Remove Cabbage remnants in good time!]—*Obst- u. Gemüseb.*, lxxxiv, 11, pp. 145–147, 4 figs., 1938.

The author has emphasized elsewhere the great importance of excluding the peach aphid (*Myzus persicae*) from the vicinity of German potato fields owing to its activity in the transmission of virus diseases [*R.A.M.*, xviii, p. 133]. This insect is stated to be the vector of about 25 viruses affecting a number of economic and ornamental hosts besides the potato. The remnants of cabbage crops commonly left over the winter in fields, allotments, and the like harbour not only *M. persicae* (in mild situations), but also the cabbage aphid, *Brevicoryne brassicae*, known to be the carrier of six virus diseases, of which the most important are cabbage [ibid., xvi, p. 359; xvii, p. 152] and bean [*Phaseolus vulgaris*] mosaics and onion 'slime' or 'streakiness' [? yellow dwarf: ibid., xvi, p. 724].

Cook (M. T.). **Second supplement to host index of virus diseases of plants.** —*J. Agric. P.R.*, xxii, 3, pp. 411–435, 1938.

This second supplement to the author's host index of plant virus diseases [*R.A.M.*, xvi, p. 114] comprises 42 families, over 120 genera, and nearly 300 species.

Otero (J. I.) & Cook (M. T.). **Third supplement to partial bibliography of virus diseases of plants.**—*J. Agric. P.R.*, xxii, 3, pp. 263–409, 1938.

This third supplement to the authors' partial bibliography of the literature of plant virus diseases [see preceding abstract] includes papers published in 1937 and 1938.

ESAU (KATHERINE). **Some anatomical aspects of plant virus disease problems.**—*Bot. Rev.*, iv, 10, pp. 548–579, 1938.

This is a critical survey and discussion of 146 recent papers of outstanding importance in relation to certain pathological changes in plant anatomy induced by virus diseases. The subject is treated under the following headings: the nature of the anatomical modifications induced in plants by virus diseases; histology of hosts and the problem of classification of viruses; anatomical aspects of the plant tissue relations of certain viruses; and studies on phloem abnormalities. In conclusion the writer emphasizes the importance of a clear understanding of normal plant anatomy as a foundation for the study of the relationship between virus and host.

OVCHAROV [OVTCHAROFF] (K.). **On the ferment of pathogenic fungi causing the splitting off of urea from protein.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xx, 5, pp. 377–380, 1 fig., 1938.

In further experiments on the production of urea by fungi [*R.A.M.*, xvii, p. 197] the author demonstrated that an enzyme present in pure cultures of *Verticillium albo-atrum*, *Botrytis cinerea*, and *Pythium de Baryanum* was capable of splitting off urea from gelatine in the presence of toluol and chloroform. The activity of this ferment, for which the name deurease is suggested, was studied on 20-days' old cultures of these three fungi grown on various media and found to be higher on that containing edestin as the source of nitrogen than on those containing glutenin or gelatine. The greater part of the enzyme was retained in the mycelium as endoenzyme and the rest excreted into the nutritive media. The enzyme is considered to play an important part in the assimilation of nitrogen from protein by fungi.

RENNERFELT (E.). **Beobachtungen über den gegenseitigen Einfluss einiger Pilze aufeinander.** [Observations on the reciprocal influence of certain fungi on one another.]—*Svensk bot. Tidskr.*, xxxii, 3, pp. 332–345, 4 figs., 4 graphs, 1938.

In pure culture on a synthetic medium of mineral salts with the addition of various carbohydrates, *Penicillium rugulosum* exerted two diametrically opposite effects on the growth of *Cadophora* [*Phialophora*] *fastigiata*, an agent of blue stain in wood pulp in Sweden [*R.A.M.*, xvii, p. 821], one stimulatory and the other inhibitory, the former due to a rapidly diffusing substance, probably bios, and the latter to one diffusing more slowly and possibly identical with heteroauxin (β-indolyl acetic acid). *P. fastigiata* temporarily retarded the development of *Penicillium rugulosum*, but the latter eventually gained the upper hand and outgrew its antagonist. In mixed cultures the colour of the mycelium of *P. rugulosum* ranged from greyish-green to brick-red according to the carbohydrate supplied, and that of *Phialophora fastigiata* was uniformly red. In mixed cultures with *Rhodotorula glutinis*, *Torulopsis candida*, and *Geotrichoides* No. 103, also isolated from wood pulp [ibid., xvi, p. 575], a temporary stimulus to growth was afforded by *Penicillium rugulosum* only in the case of *T. candida* which, like *Phialophora fastigiata*, grows poorly on a synthetic medium. A red coloration was

imparted to the normally hyaline *T. candida* and *G.* No. 103, whereas *R. glutinis* was deprived of its carotin-forming capacity.

HARDING (DOROTHY) & SCHMIDT (CATHERINE M.). **Boron as a plant nutrient. A bibliography of literature published and reviewed, January, 1936, to June, 1938, inclusive. (With index.)**—83+xvi pp., American Potash Institute, Inc., Washington, D.C., 1938. [Mimeographed.]

This annotated bibliography of the literature of boron as a plant nutrient contains nearly 400 entries.

LESZCZENKO (P.). **Dezynfekcja gleby zakażonej rakiem Ziemniaczanym Synchytrium endobioticum (Schilb.) Perc.** [Disinfection of soil infected with Potato wart disease *Synchytrium endobioticum* (Schilb.) Perc.]—*Roczn. Ochr. Rośl.*, v, 4, pp. 118–119, 1938.

In this summary of a paper read at a conference on plant protection in Poland in 1938 the author states that both light sandy and heavy clay soils, heavily infested with *Synchytrium endobioticum* [*R.A.M.*, xvi, p. 119], were completely sterilized when treated with 0·4 and 0·8 per cent. solutions of formaldehyde (1 and 2 per cent. formalin), applied at a rate of 12·5 l. per sq. m., whereas weaker solutions failed to sterilize the soil completely, although they somewhat reduced the percentage of infection in these plots.

LESZCZENKO (P.) & SZYMAŃSKI (W.). **Wpływ soli potasowych na zmianę wrażliwości kłębów przeciw rakowi Ziemniaczanemu.** [The influence of potassium salts on the degree of susceptibility of tubers to Potato wart disease.]—*Roczn. Ochr. Rośl.*, v, 4, pp. 166–168, 1938.

In a study on the potato wart disease [*Synchytrium endobioticum*: see preceding abstract], conducted in Poland in 1936, tubers of the potato variety Nowa Industria, artificially inoculated by means of fresh tumor material, were planted in plots fertilized with different potassium salts, each plot receiving the same amount of potassium. The data obtained show that in plots treated with potassium chloride (190 kg. per hect.) and potassium sulphate (215 kg. per hect.), only 59·1 and 72·7 per cent. of tubers, respectively, developed the disease as compared with 95·4 per cent. in the untreated control plots. All the other potassium salts tested reduced the proportion of diseased tubers, though to a less degree, except potassium nitrate which increased infection to 100 per cent. When double the amount of fertilizers was used, the percentage of affected tubers was increased by all treatments except potassium chloride and potassium phosphate, which reduced it from 59·1 to 45·4 and from 90·9 to 81·8 per cent., respectively.

BRAUN (H.). **Variationsstatistische Untersuchungen zur Frage der Vererbung von Krebs- und Schorfresistenz der Kartoffel.** [Variation—statistical studies on the question of inheritance of wart and scab resistance in the Potato.]—*Z. indukt. Abstamm. u. VererbLehre*, lxxv, 1, pp. 55–105, 1938.

From this discussion of the [fully tabulated] results of the author's

recent studies at the Biological Institute, Dahlem, Berlin, on the statistical factors involved in the inheritance of resistance to potato scab [*Actinomyces scabies*: *R.A.M.*, xvi, p. 556; xvii, p. 766] and wart disease (*Synchytrium endobioticum*) [ibid., xiv, pp. 465, 788; xvi, p. 119], it appears that in the latter three main groups may be distinguished, viz., (1) containing families derived from selfed lines of susceptible parent varieties or from intervarietal crosses, which yielded 0 to 89·7 per cent. resistant races; (2) comprising families arising from selfed lines of resistant varieties and intervarietal crosses, in which the percentage of resistant races never sank below 50; and (3) consisting of families produced by crosses between resistant and susceptible varieties, giving 5 to 91·4 per cent. resistant races. All the families together fall into six subgroups, two of which comprise less than 50 per cent. resistant races.

In the absence of an exact method of laboratory testing, such as Spieckermann's or Lemmerzahl's for wart disease, the scab data, based on field observations, are admittedly of a tentative and preliminary character. It is obvious, however, that the families derived from intervarietal crosses contracted on the average a lower incidence of infection than the selfed lines of the hybrid partners.

Larson (R. H.), Albert (A. R.), & Walker (J. C.). **Soil reaction in relation to Potato scab.**—*Amer. Potato J.*, xv, 11, pp. 325–330, 1938.

The general trend of results from the treatments in potato fields infested by scab (*Actinomyces scabies*) in Wisconsin [see above, p. 157] from 1935 to 1937, herein reported and tabulated, confirm previous conclusions as to the reduction of disease with increasing acidity of the soil. In no case, however, was the causal organism eliminated by the maintenance of the hydrogen-ion concentration below P_H 5·0 even for a two-year period. Contrary to Dippenaar's experience (*Sci. Bull. Dep. Agric. S. Afr.* 136, 1933), the broadcast application of sulphur at appropriate rates (from 700 to 3,000 lb. per acre) consistently reduced the incidence of infection in the susceptible Irish Cobbler and Katahdin varieties (the latter used only once in 1936) in three widely differing soil types (silt, sandy loam, and muck). No decline in the amount of scab followed the use of lime, even in quantities beyond the range of economic profitability.

Discussing the practical application of these data, the writers point out that the cost of the sulphur treatment is probably too high for southern Wisconsin muck soils, while in the central districts it should seldom be necessary unless to counteract heavy liming; for the intensive potato-growing Antigo district the reduction of the P_H to 5·2 or 5 by sulphuring is likely to prove effective in scab control.

Racicot (H. N.), Savile (D. B. O.), & Conners (I. L.). **Bacterial wilt and rot of Potatoes—some suggestions for its detection, verification, and control.**—*Amer. Potato J.*, xv, 11, pp. 312–318, 2 figs, 2 diags., 1938.

A popular account is given of the symptoms and mode of overwintering and dissemination of bacterial wilt and rot of potatoes caused by an organism closely related to *Phytomonas michiganensis* [*Aplano-*

bacter michiganense] and *P. sepedonica* [*Bacterium sepedonicum*] in Canada [*R.A.M.*, xvi, p. 628], together with directions for its control by the exclusive use of healthy seed, for making smears from diseased plants, and for the collection and dispatch of specimens for purposes of verification.

Chucka (J. A.) & Brown (B. E.). **Magnesium studies with the Potato.**—*Amer. Potato J.*, xv, 11, pp. 301–312, 1938.

The results of experiments in Aroostook County, Maine, from 1930 to 1937 are stated to have proved conclusively that the so-called 'potato sickness' (chlorosis) prevalent in the district is specifically associated with magnesium deficiency [*R.A.M.*, xii, p. 654; xvi, p. 370], and may be effectively combated by the application to the soil of 25 lb. magnesium oxide per acre. Satisfactory control was further obtained by the use of sulphate of potash, magnesia or calcined kieserite. Dolomitic limestone, applied broadcast at the rate of 30 lb. per acre, also assists in the reduction of soil acidity and helps to build up a reserve of magnesium, but the use of high calcium limestone is not recommended, having been almost invariably followed by a depression of yield. Substantial yield increases in Green Mountains and Irish Cobblers (35 and 17 bush. per acre, respectively, in 1934) were secured by the incorporation of magnesium sulphate with the ordinary potato fertilizer, either as a top-dressing or in the spray mixture, particularly in fields where severe chlorosis developed shortly after the emergence of the plants.

Burr (S.) & Millard (W. A.). **Two Potato diseases. Variety trials for resistance to spraing and internal rust spot (canker type) in Potatoes.**—Reprinted from *Scot. Fmr*, 1 p., 2 figs., 11th November, 1938.

In Yorkshire, the form of potato internal rust spot known as 'canker' or the 'canker type' is far more destructive than spraing [*R.A.M.*, xvii, pp. 409, 410]. It is characterized by spots hardly visible at lifting, but which develop later and often break down, with the result that cavities form and the tuber frequently rots. Both conditions occur on light, sandy soil lacking in organic material, but soil analyses do not afford any indication of the importance of this factor; when potatoes were grown in two fields of closely similar soil analyses those from one field developed severe internal rust spot of the canker type, while those from the other were completely unaffected.

In a varietal resistance test in a field where both diseases were known to occur with uniform distribution the varieties most susceptible to spraing were Gladstone, Arran Cairn, and Arran Chief, which showed, respectively, 1, 10, and 15·8 per cent. spraing at the first examination made by cutting the tubers after the crop was lifted, and 2, 10·7, and 15 per cent. at the second, made in February, 1938. The varieties most susceptible to internal rust spot (canker type) were Eclipse, Golden Wonder, Bishop, Kerr's Pink, Great Scot, Gladstone, and Arran Cairn with, respectively, 68·8, 55·5, 53, 61, 59·1, 28·5, and 47·5 per cent. disease in the first cutting and 81·8, 73, 67, 63, 55, 57, and 42 per cent. in the second. The varieties most resistant to 'canker' were Arran Consul, Arran Chief, and King Edward, with 18·1, 19, and 27·2 per cent

disease, respectively, in the first cutting, and 22·2, 20, and 42 per cent. in the second.

The incidence of spraing in the soil selected was comparatively low, but Arran Cairn, Gladstone, and Arran Chief were too much affected to be grown profitably. The data obtained confirmed observations made over a number of years, that Arran Consul is the safest variety to grow, with respect to 'canker', as it gives a crop that is only slightly affected, even after being stored until spring. On land less liable to 'canker', King Edward may also be grown profitably. There appears to be no relation between the susceptibility or resistance of any variety to spraing and its reaction to 'canker'.

COSTA (A. S.) & KIEHL (J.). **Una molestia da Batatinha—'necrose do tôpo'—causada pelo virus de 'vira-cabeça'.** [A Potato disease—top necrosis—caused by the 'vira-cabeça' virus.]—*J. Agron., S. Paulo*, i, 3, pp. 193–202, 3 pl., 1938. [English summary.]

Since 1936 a potato disease (termed 'vira-cabeça') ['twisted head'] of the acronecrosis [*R.A.M.*, xvi, p. 480; and cf. xvi, p. 779] type has been observed in experimental plots in São Paulo, Brazil, and a similar disorder was reported to the writers by Dr. J. Tucker from the Argentine, where tobacco is affected by the 'corcova' ['hunchback'] virus [ibid., xvii, p. 564] to which the potato disease may possibly be due. The tendency of the disease to develop in patches suggests the association of infection with foci of the vector (*Frankliniella* sp.). The symptoms include ring spots on the leaves (which are readily detachable), and spotting of the petioles and peduncles; sections through the last-named sometimes reveal pale ferruginous lesions corresponding with those on the surface. The tubers of diseased plants are similarly affected, both externally and internally. The 'vira-cabeça' virus from Katahdin potatoes was transmitted by rubbing to Geudertheim tobacco and Maule's Earliest of All and Mikado tomatoes, on which the typical symptoms developed. In a preliminary test Katahdin potatoes were infected by viruliferous individuals of the insect vector from diseased tobacco. Although the symptoms of the Brazilian disorder bear some resemblance to those of yellow dwarf [ibid., xvii, p. 701], the ready transmission of the former by insects indicates that the two are not identical.

SHEFFIELD (F. M. L.). **Vein clearing and vein banding induced by Hyoscyamus III disease.**—*Ann. appl. Biol.*, xxv, 4, pp. 781–789, 1 pl., 3 figs., 1938.

The *Hyoscyamus* virus III causes in tobacco [*R.A.M.*, xvii, p. 344] a disease manifested by clearing of the veins followed later by vein-banding. A few days after inoculation a strip up to 1 mm. in width along the principal veins becomes yellow and after persisting for about two days the yellow discoloration becomes diffuse. After about another week dark green bands appear along many of the veins, varying in width from very narrow to several millimetres. Microchemical and other tests of artificially infected young tobacco plants showed that no anatomical or cytological abnormalities occur in the leaves during clearing, the yellow colour of the cleared areas being due to abnormal development or distribution of the chloroplasts. During veinbanding hypoplasia

becomes apparent in the interveinal areas, and considerable hypertrophy in the tissues near the veins. Intracellular inclusions occur in abundance in the phloem, epidermis, and all types of parenchymatous tissue. The virus content per unit volume of cleared tissue was calculated to be about 6 to 11 times as great as that of banded tissue, while the yellow interveinal areas of older leaves contain more virus than the banded ones and less than the cleared.

Borzini (G.). **Osservazioni su due specie di Pythium parassite delle piante di Finocchio (Foeniculum vulgare L.).** [Observations on two species of *Pythium* parasitic on Fennel plants (*Foeniculum vulgare* L.).]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 2, pp. 185–194, 2 pl., 2 figs., 1938.

Further studies are reported on the two species of *Pythium* found in the outer covering of the 'bulbs' of *Foeniculum vulgare* plants growing in Italy [*R.A.M.*, xvii, p. 136]. Observations showed that one species (referred to as *Pythium* No. 1) was more actively parasitic than the other (*Pythium* No. 2) and this was confirmed in inoculation experiments. Both attacked only the outer scales of the 'bulbs', the former causing spots on the veins, and the other, greenish-brown discoloration in the tissues adjacent to the wound.

Detailed descriptions are given of the two species of *Pythium*. Both are classified in the *Plerospora* section of the genus but are stated to differ from the two species, *P. diameson* and *P. plerosporon* [ibid., xi, 546] comprising this group. Neither is identified.

Cucurbita pepo plants grown near where the infected fennel had been found showed a serious affection of the collar attributed mainly to *Pythium* No. 1.

Stevenson (J. A.) & Rands (R. D.). **An annotated list of the fungi and bacteria associated with Sugarcane and its products.**—*Hawaii. Plant. Rec.*, xlii, 4, pp. 247–314, 1938.

This is an annotated list of fungi and bacteria recorded on sugar-cane throughout the world. The essential characters of each organism are given, together with its recorded geographical distribution, any synonyms found in phytopathological literature, the original citation, and the reference, where possible, to the description in Saccardo's 'Sylloge fungorum'. The more extensively studied organisms concerned in raw sugar deterioration and sugar-house sanitation are also included.

Abbott (E. V.). **Chlorotic streak of Sugar Cane in the United States.**—*Phytopathology*, xxviii, 11, pp. 855–857, 1 fig., 1938.

In order to secure evidence as to the transmissibility of the disorder recently described as chlorotic streak of sugar-cane in Louisiana [*R.A.M.*, xvii, p. 840], cuttings of three affected varieties were divided into two lots, one of which was immersed in hot water at 52° C. for 20 minutes and the other left untreated as a control. Single-eye pieces from each lot were then planted in steamed soil in an insect-proof greenhouse. All the plants arising from the hot-water treated material emerged in a healthy state and remained sound during a six-month period of observa-

tion, whereas 64 per cent. of those from the untreated control cuttings developed the typical symptoms of the disturbance. In August, 1937, the unreleased seedling varieties C.P. 29/99, 33/229, 33/243, and 33/253 were found to be affected, and a recurrence of infection was detected in the ratoons and plant cane in the following spring; in the first-named variety germination was reduced. In a later survey by R. D. Rands and the writer, 10 to 15 per cent. infection was observed on the commercial variety C.P. 29/320, as well as on other seedlings. At least four parishes of Louisiana are now known to be affected by chlorotic streak, the possible origin of which in the United States is briefly discussed.

Sydow (H.). **Fungi himalayenses.** [Himalayan fungi.]—*Ann. mycol., Berl.*, xxxvi, 5–6, pp. 437–442, 1938.

This is a critically annotated list of 44 fungi (including four new species) with their respective hosts collected in the Himalaya districts Kulu, Lahul, and Spiti by Sultan Ahmad on behalf of the Urusvati Roerich Research Institute, Naggar, Kulu, Punjab, and identified by the author.

Rayss (T.). **Contributions à la connaissance des Urédinées de Palestine.** [Contributions to the knowledge of the Uredineae of Palestine.]—Reprinted from 'Hommage au Professeur E. C. Teodoresco', Bucharest, 1937, 13 pp., 4 figs., 1937. [Received January, 1939.]

Included in this annotated list of 41 rusts collected in Palestine since the author's previous contribution (with T. Săvulescu) to the same subject [*R.A.M.*, xv, p. 683] are four new species [with Latin diagnoses]. Among other records may be mentioned *Puccinia allii* on onion leaves [ibid., xvi, pp. 279, 563] and scales and foliage of *Allium ampeloprasum*; *P. antirrhini*, found in 1936 and spreading with alarming rapidity on *Antirrhinum majus* in Jerusalem and Tel Aviv [ibid., xviii, p. 11]; *P. maydis* on maize [ibid., xvii, p. 671]; *P. scolymi* on *Scolymus hispanicus*; and *Uromyces fabae* on lentils [ibid., xvii, p. 220].

Hiratsuka (N.). **Miscellaneous notes on the East-Asiatic Uredinales with special reference to the Japanese species (IV).**—*J. Jap. Bot.*, xiv, 9, pp. 558–563, 1 fig., 1938.

Included in this further instalment of the author's critically annotated list of eastern Asiatic (mainly Japanese) Uredinales [*R.A.M.*, xvii, p. 347] is *Uredo deutziicola* n.sp. [with a Latin diagnosis], forming inconspicuous, pale yellow, scattered or loosely aggregated, circular spots, 0·1 to 0·3 mm. in diameter, on the leaves of *Deutzia pulchra* var. *formosana*. The new rust differs from the related *U. deutziae* Barcl. in the smaller dimensions of its spores (17 to 25 by 12 to 16 μ).

Hino (I.). **Illustrationes fungorum bambusicolorum.** [Illustrations of Bamboo-inhabiting fungi.]—*Bull. Miyazaki Coll. Agric. For.* 10, pp. 55–64, 10 figs., 1938.

Latin diagnoses, illustrated by drawings, are given of ten fungi found on bamboo in Japan, including *Myriangium bambusae* Hara [*M. haraeanum*: *R.A.M.*, xiii, p. 656] on living leaves of *Pleioblastus pumilis*, *Coccodiella arundinariae* Hara on the same, *Phragmothyrium semiarun-*

dinariae [ibid., xiv, p. 107] on living leaves of *Semiarundinaria fastuosa*, *Asterinella hiugensis* [loc. cit.] on living stems of *Phyllostachys reticulata*, *Chaetosphaeria yosie-hidakai* n.sp. on living stems of *Sasamorpha purpurascentis*, and *Leptosphaeria tigrisoides* on living stems of *P. reticulata*. Two new genera are represented by *Asterotheca nigrocornis* n.g., n.sp. on dead culms of *P. reticulata*, and *Chaetosphaerulina yasudai* n.g., n.sp., on dead bamboo culms.

ENDÔ (S.). **Revised host list of Hypochnus centrifugus Tul. in Japan.**—*Bull. Miyazaki Coll. Agric. For.* 10, pp. 65–82, 1938.

Following up previous studies by himself and T. Watanabe on the host range of *Hypochnus centrifugus* [*Corticium centrifugum*] in Japan [*R.A.M.*, xiv, p. 719], the writer presents a revised list of 216 plants subject to infection by the fungus, of which 28 are new records for Japan, including *Brassica campestris* subsp. *napus* var. *nippooleifera* Makino, *Poa trivialis* f. *folii albovittai*, *Setaria viridis* var. *genuina*, *Phormium tenax*, Buntan grapefruit, and loquat.

NAGORNY (P. I.). Микромицеты Чайного куста. [Micromycetes of the Tea bush.]—*Bull. Georgian Exp. Sta. Pl. Prot., Tbilisi* [*Tiflis*], *1938*, Ser. A, 1, 130 pp., 1938. [German summary.]

In a short foreword L. Kantshaveli states that this book represents a posthumous compilation of Nagorny's notes on the parasitic diseases of the tea bush throughout the world but with special reference to those that have been recorded and studied in the Caucasus since the introduction of tea cultivation in that country [cf. *R.A.M.*, ix, p. 412].

BALLS (A. K.) & MARTIN (L. F.). **Amylase activity of mosaic Tobacco.**—*Enzymologia*, v, 4, pp. 233–238, 1 graph, 1938.

In experiments at the Food Research Division, Bureau of Chemistry and Soils, United States Department of Agriculture, tobacco infected by common or yellow mosaic [see following abstracts] was found to exhibit definite abnormalities in the rate of amylase development, presumably as a result of disturbances in the cell metabolism. Mature Wisconsin Havana plants suffering from common mosaic have a subnormal amylase content of 0·305 $(A)^s$ (saccharifying activity) and 0·035 $(A)^v$ (liquefying activity) as compared with healthy ones (0·514 and 0·122, respectively), while that of plants affected by yellow mosaic is abnormally high (2·22 and 0·370, respectively). The following $(A)^s$ values were obtained in a comparative extraction test on 15-week-old plants 34 days after inoculation with common mosaic: at room temperature (shaken 28 hours at 28° to 30° C.) 0·440; cold (standing four days at 0° to 2°) 0·451, the corresponding figures for healthy plants being 0·440 and 0·654 respectively. The virus protein itself is without effect on the amylolytic activity of either tobacco or malt. Since the evidence for either an inhibitor or activator of tobacco or of malt amylase in the extracts both of healthy and infected tobacco is negative, it may be concluded that the observed differences are in the amount rather than in the intrinsic activity of the amylase formed in diseased tissues.

NORVAL (I. P.). **Derivatives from an unusual strain of Tobacco-mosaic virus.**—*Phytopathology*, xxviii, 10, pp. 675–692, 6 figs., 1 graph, 1938.

Sixty-two variants of Jensen's weakly infectious, non-systemic strain of tobacco mosaic, J14 [*R.A.M.*, xvi, p. 418], were isolated from the original stock by passage through Turkish tobacco, tomato, and *Nicotiana sylvestris*, and were shown by the symptoms they induced on the first-named host to fall roughly into two classes, A (non-systemic) and B (becoming systemic), the former consisting of the local yellow type (N(orval) 1 and 12 other strains) and the latter of (1) slow moving yellow type (N50, 88, 103, 107, 123); (2) fast moving yellow (N4, 8 and 13 other strains); (3) fast moving severe yellow (8 strains); (4) non-distorting green (5 strains); (5) distorting green (14 strains); and (6) necrotic (N2, 80).

These widely divergent variants cover a similar range to those derived by Jensen from tobacco mosaic virus No. 1, exclusive of the green types, which are automatically excluded by his method of experimentation. The slow moving yellow strains N50, 103, and 107 closely resemble J111, being weakly infectious, causing neither vein-clearing nor typical mottle, and producing secondary lesions in the form of isolated yellow spots with green centres, or yellowing radiating from the veins. N88 assumes a distinct position in this group. Like J104 it induced a feebly infectious, slow moving, yellow spotting in tobacco, and minute, necrotic lesions, surrounded by a yellow halo, on *N. glutinosa*. The fast moving yellow strains may be divided into two types on the basis of their severity on tobacco and other hosts. The milder form causes yellow mottling, some foliar distortion, and a tendency to yellow and green ring formation on tobacco, while the severe type, resembling J14D1, induces intense yellowing of the leaves, followed by necrosis of the tissues. On tomato the severe fast moving mosaics cause primary and secondary necrosis, rapidly killing young plants. The necrotic strain N2 differed from J14 in producing systemic symptoms in young tobacco plants and *N. sylvestris*. Tomato plants reacted in a similar way as to J14 except that the growing point was usually spared.

A second group of mutants obtained by L. O. Kunkel in the course of serial transfers of J14 to tobacco over a period of 18 months may also be classified on a symptomatological basis. The A (non-systemic) group is not represented, but the B (systemic) group includes (1) yellow type (none), and the latter (1) slow moving yellow type (K(unkel) 16); (2) fast moving yellow type (K1, 5, 9, 11, 12, and 14); (3) fast moving severe yellow type (K17, 13); (4) non-distorting green type (K10); (5) distorting green type (K2, 3, 4, 6, 7, 8, and 18); and (6) greenish-yellow forming necrotic rings (K15). The slow moving yellow strain K16 approximates closely to N50, 103, and 107 in tobacco, while all produce concentric yellow and green rings on tomato leaves. Among the fast moving types, K1, 5, 9, 11, 12, 14 were indistinguishable from N8 and 4 on tobacco, tomato, *N. sylvestris*, and *N. glutinosa* at greenhouse temperatures of 90° F. and upwards, while K13 appears identical on tobacco and tomato with several of the virulent N types. Necrotic ring type K15, however, is without a counterpart in the N set, producing on tobacco symptoms closely similar to those of E. M. Johnson's ring mosaic [ibid., x, p. 60].

On *N. sylvestris* K 15 produced large, greenish-yellow lesions, becoming completely necrotic, and necrotic spotting of the veins of young leaves, sometimes commencing in the shape of rings. The plants were killed in about a month. On tomato the symptoms closely resembled those caused by N2.

A correlation was experimentally established between rapidity of movement in tobacco and tomato on the one hand and virulence on the other, the local yellow-type strains being weakly infectious, the slow moving yellow intermediate, and the fast moving yellow highly infectious (ten times as much so as the slow moving).

The slow moving yellow and non-distorting green strains were infrequently isolated (6 times each) in comparison with the local yellow, fast moving yellow, severe systemic, and distorting green (13, 21, 13, and 21 times, respectively). The author regards all the above-mentioned strains as mutants, many of which have arisen more than once from the original strain, and advances evidence against the occurrence of any of them as contaminants. By using host plants of differential sensitivity he recognizes factors for necrosis and suggests that a study of virus proteins may throw light on the nature of the gene.

THUNG (T. H.). **Smetstof en plantencel bij enkele virusziekten van de Tabaksplant IV.** [Infective principle and plant cell in some virus diseases of the Tobacco plant IV.]—*Tijdschr. PlZiekt.*, xliv, 5, pp. 225–246, 4 pl., 1938. [English summary.]

Continuing his studies at the Vorstenland Experiment Station, Java, on the protective action of certain tobacco viruses against others [*R.A.M.*, xvi, p. 414], the writer describes two recently detected local forms of white mosaic, termed VIb and VIc, both of Jensen's slow moving type [see preceding abstract], which also includes the Rotterdam B disease [ibid., xvii, p. 632].

Leaves affected by VIb mosaic show dark green, pale green, white, and necrotic areas at maturity, but the younger foliage shows only dark and light green patterns. The infectivity of the juice from the dark green areas is very low or non-existent, the degree of virulence increasing parallel with loss of colour, reaching a maximum in the white areas, and gradually declining in the necrotic regions. The distribution of the virus is restricted to certain cells of the growing points at the top of the plants, so that the actual foci of infection are constituted by only a limited number of cell groups in the newly formed leaves.

The symptoms of VIc mosaic consist of white spots, expanding with age, on the older leaves only: these are the sole source of the infective principle. The juice of young leaves affected by Rotterdam B disease is also devoid of the virus, with which the mature foliage, on the other hand, is completely permeated.

Symptoms of VIb mosaic and Rotterdam B disease develop in the tops of healthy plants inoculated with juice from the most virulent parts of diseased leaves a week and ten days, respectively, after inoculation. The inoculation of healthy foliage with a mixture of 1 c.c. juice from fully grown VIb-diseased leaves and the same quantity from (*a*) ordinary mosaic material, (*b*) white mosaic, and (*c*) Holmes's distorting strain results in the formation of some VIb lesions on the inoculated leaves

only, those produced later showing exclusively the symptoms of the accessory virus. In the case of a similar mixture of VIb and (*d*) ring spot necrosis two or three young leaves following the inoculated ones also contract VIb symptoms but the top foliage exhibits only ring spot lesions. A combination of VIb and (*e*) severe mosaic produces mixed patterns of the two diseases. When the virus of VIb mosaic is inoculated into a given leaf and that of white or severe mosaic or ring spot necrosis into the next ones above or below, VIb symptoms appear both on the inoculated leaf and on the nearest halves of the two next leaves. On the top leaves formed six weeks after combined inoculation with VIb and ordinary or white mosaic and Holmes's distorting strain no symptoms of the first-named virus are to be seen, the other diseases being completely dominant, whereas ring spot permits a slight development of VIb up to the top leaves, and in a combination of VIb and severe mosaic mixed patterns are formed, with the latter somewhat predominating in the uppermost foliage only. When the VIb mosaic virus is inoculated into a given leaf and that of ordinary mosaic, Holmes's distorting strain, or white mosaic into the third leaf above or below, the first-named is entirely superseded by the others in the top leaves. When severe mosaic or ring spot were inoculated into the third leaf above that artificially infected by VIb, symptoms of severe mosaic or ring spot only developed in the treated plants, while the introduction of the severe mosaic or ring spot virus into the third leaf below that inoculated with VIb induced the formation of mixed patterns. The joint inoculation of viruses VIb and white and severe mosaic results in the reproduction of the three virus patterns in the top leaves. On the other hand, in a combination of VIb with white mosaic the latter is completely predominant, while severe mosaic produces a mixed pattern both with VIb and white mosaic. Severe mosaic thus apparently protects VIb against domination by the white virus. The inoculation of either ordinary or white mosaic into young VIb-diseased leaves containing areas without infective juice results in the domination of the former in the top foliage after a month, whereas no extraneous symptoms develop in leaves already pervaded by VIb.

The inoculation of ordinary or white mosaic into very young leaves infected by Rotterdam B virus is followed by the apparent domination of the former; this is, however, merely temporary, being replaced after one month by mixed patterns of Rotterdam B and ordinary or white mosaic. Inoculations of ordinary or white mosaic into older leaves infected by Rotterdam B are unsuccessful. The Rotterdam B virus, when inoculated into very young leaves of plants infected by VIb or any of the other five viruses under investigation, predominates in the early stages of invasion, but after six weeks mixed patterns appear on the uppermost leaves. White mosaic obtains no access to young leaves with apparently pure Rotterdam B symptoms on plants infected with ordinary mosaic, but the first-named virus forms mixed patterns with severe mosaic on inoculation into severe mosaic plants showing apparently pure Rotterdam B symptoms. The Rotterdam B virus is also capable of infecting the older leaves of plants affected by one of the other diseases under discussion, but in such cases there is no initial domination and mixed patterns soon appear. Thus, the infective

principle of Rotterdam B is evidently more powerful than those of the other viruses, but its movement is too slow to ensure complete domination even over the slow moving VIb. In cases of severe attack by Rotterdam B disease the affected plants soon die off, but in milder cases premature flowering results, indicating that the virus probably influences the physiological processes of the plant through the cell protoplasm.

Ross (A. F.) & Stanley (W. M.). **The partial reactivation of formolized Tobacco mosaic virus protein.**—*J. gen. Physiol.*, xxii, 2, pp. 165–191, 5 graphs, 1938.

This is an expanded account of the writers' experiments in the reactivation of formolized tobacco mosaic virus protein, a note on which has already appeared from another source [*R.A.M.*, xvii, p. 562].

Kausche (G. A.) & Stubbe (H.). **Über Aktivierungseffekte mit Röntgenstrahlen am Tabakmosaikvirus.** [On the activation effects of Röntgen-rays on the Tobacco mosaic virus.]—*Naturwissenschaften*, xxvi, 45, pp. 740–741, 1938.

The exposure of preparations of varying concentrations of the tobacco mosaic virus [see preceding and next abstracts] to irradiation by X-rays (115 kilovolts, 10 milliampères, 1 mm. aluminium filter) [cf. *R.A.M.*, xvi, p. 347] resulted in an access of virulence as gauged by the numbers of local lesions produced on *Datura stramonium* by the various preparations. Thus, on 16th June, 1938, where the non-irradiated control (1·5 mg. virus per c.c. solution, m/15 phosphate buffer, P_H 7·0) caused the development of 2,969 lesions, the same preparation exposed to 5,000 r induced 3,342. On 12th July the corresponding figures for a 1·08 mg. virus concentration, m/75 phosphate buffer, were as follows: control, 10,000, 12,000, and 14,000 r gave 813, 1,615, 2,859, and 3,659 lesions, respectively. On 23rd July the following results were obtained with a 1·69 gm. concentration, 99·7 per cent. virus protein, salt content below 0·01 per cent., $K = 1{\cdot}5.10^5$; control, 10,000, 18,000, and 19,000 r produced 2,337, 3,773, 5,042, and 2,603, respectively. In one test on *Nicotiana glutinosa* (1·5 mg. virus) on 16th June, the number of lesions was increased from 3,544 to 5,900 by irradiation at 5,000 r.

The following possible interpretations of these observations are briefly considered. (1) The activating effect consists in the multiplication of the number of already existing individual particles per volume unit of dispersion preparation. Such multiplication may be attributed to molecular disintegration caused by the impact of the rays, in which case the virus molecule, as at present understood, would no longer be the last infectious unit. (2) The activating effect resides in the multiplication of the biologically active groups in or on the virus molecule itself, so that fewer molecules are necessary to produce a local lesion. (3) After purification the virus is *a priori* in a partially or completely aggregated form, in which case irradiation would bring about the dissolution and disaggregation of such complexes. The consequence of this process would be an expansion of the active surface due to multiplication of the individual particles, but would in no sense connote an increase of the virus content, reckoned in nitrogen units. Primary irradiation effects

would not here be involved, but the X-rays have been shown by several workers to act in a particular way on the degree of ionization at a surface and produce cryolysis.

It is important that the biological action of the X-rays on the tobacco mosaic virus should not be taken as necessarily applying to virus diseases in general, since preliminary experiments with these rays and ultra-violet light on other viruses have given different results.

KAUSCHE (G. A.). **Über Aktivierungseffekte mit γ-Strahlen am Tabakmosaikvirus.** [On activation effects with γ-rays on the Tobacco mosaic virus.]—*Naturwissenschaften*, xxvi, 45, p. 741, 1938.

In continuation of his experiments with X-rays [see preceding abstract], the writer subjected a preparation of tobacco-mosaic virus (m/30 phosphate buffer 1 : 10, virus content *ca* 0·7 mg. per c.c.) to 1, 2, and 20 hours' irradiation from a gamma-ray mesothorium apparatus (10 mg. radium), with the result that the number of local lesions secured by inoculation on *Datura stramonium* was raised from 167 in the non-irradiated control series to 229, 468, and 272, respectively, the corresponding activity limits being 1 : 12,800, 1 : 102,400, 1 : 409,600, and 1 : 1,638,400, respectively. Attention is drawn to the important fact that there is no necessary correlation between the amount of virus concentration and the severity of infection induced by a given preparation.

SREENIVASAYA (M.) & PIRIE (N. W.). **The disintegration of Tobacco-mosaic virus preparations with sodium dodecyl sulphate.**—*Biochem. J.*, xxxii, 10, pp. 1707–1710, 1938.

A detailed account is given of the writers' experiments at the Biochemical Laboratory, Cambridge, on the disintegration of tobacco-mosaic virus preparation by means of sodium dodecyl sulphate (SDS). By means of an elaborate technique, which is described in full, it was found that besides inactivating the virus and breaking down the protein of high molecular weight, the SDS separates the nucleic acid from the protein to which it was attached. The nucleic acid-free protein, which may be repeatedly precipitated with ammonium sulphate gives all the usual protein colour reactions and precipitates with the ordinary precipitants, while its absorption spectrum approximates closely to that of other proteins, with a maximum at 2,750 to 2,800 Å. and general absorption below 2,500 Å. This is considered to support the view that the intense absorption maximum at 2,600 Å. found in tobacco mosaic and [tomato] bushy stunt [ibid., xviii, p. 143] virus preparations is due to nucleic acid, being absent from the nucleic acid-free protein preparations.

Numerous attempts at fractionation have shed some light on the constitution of the protein of high molecular weight, which is the sole recognizable component of a fully active virus preparation: it seems to disintegrate into a nucleic acid and a protein too large to traverse a cellophane membrane but too small to sediment in a few hours in a centrifugal field of 17,000 times gravity. The evidence so far seems to suggest that the individual submicroscopic rods, from which the rod-shaped aggregates are built up, are themselves composed of a number of similar or identical proteins of normal molecular weight.

Kausche (G. A.). **Über den färberischen Nachweis des Tabakmosaikvirus.** [On the staining test for the Tobacco mosaic virus.]—*Naturwissenschaften*, xxvi, 45, pp. 741–742, 2 figs., 1938.

The following technique has been found effective in the identification by staining of the tobacco mosaic virus [see preceding abstracts]. Expressed juice of diseased and healthy tobacco plants is filtered over animal charcoal and adjusted to P_H 5·5 with 5 per cent. acetic acid in a semi-saturated ammonium sulphate solution. Ammonium sulphate is added in the proportion required to induce precipitation of the virus protein. From a drop of the resultant suspension an air-dry smear is prepared, fixed with alcoholic picric acid, and stained for 24 hours in azure eosin solution (1 : 400); differentiation from the potato virus X [*R.A.M.*, xvii, p. 619] is effected by means of dilute acetone. The fine crystals of the tobacco mosaic virus form a very delicate, well-defined, filiform network, the threads of which are obviously composed of single fibrils. The potato virus X falls into a diffuse protein precipitate of the agglutination type. Ovalbumin and tobacco plant albumin also settle on the slide and react positively to stains, but unlike virus protein, they are more or less readily decolorized by acetone. Both tobacco mosaic and potato virus X take the Victoria blue stain (1 : 1,200) in 20 minutes, but carmines and Feulgen's reagent gave negative results.

Price (W. C.). **Studies on the virus of Tobacco necrosis.**—*Amer. J. Bot.*, xxv, 8, pp. 603–612, 2 figs., 2 graphs, 1938.

A careful search by the writer for the presence of tobacco necrosis virus [*R.A.M.*, xvii, p. 706] in roots of old plants of tobacco, *Nicotiana rustica*, *N. langsdorffii*, and tomato at the Rockefeller Institute, Princeton, New Jersey, was without result, but a single plant out of 180 seedlings raised from tobacco seed supplied by K. M. Smith contained the virus or one very closely allied to it in its roots. This strain was lost, however, before experiments were made with it.

In inoculation experiments with the necrosis virus on Turkish tobacco symptoms developed more rapidly in plants inoculated in the afternoon than in those inoculated in the morning. The minimum incubation period was 18 hours and the maximum 24, or 21½ and 26 hours, respectively, on a less sunny day. No other virus is known to produce symptoms so quickly. When the logarithms of the numbers of lesions produced in the Black variety of cowpea were plotted against those of the dilutions of virus used for inoculation, the points were found to lie reasonably close to a straight line with a slope of about 0·7. The virus from primary necrotic lesions had a dilution end-point of about 10^{-6} and an infectivity, therefore, about 1/10 as great as that of tobacco mosaic virus in the juice of tobacco plants. The thermal death-point was 90° to 92° C. The virus seemed to be fairly stable over a wide range of hydrogen-ion concentrations, although it is suggested that no definite conclusions should be drawn until experiments with purified samples of virus can be conducted. Successful inoculation was achieved by spraying a 1 in 10 dilution of juice containing the virus, by means of an atomizer, over the leaves of Turkish tobacco, *Nicotiana glutinosa*, *N. rustica*, three varieties of bean (*Phaseolus vulgaris*), and cowpea,

large numbers of lesions developing on leaves rubbed with a finger tip or a cheese cloth pad after spraying, and only a few in the unrubbed ones. Natural transmission of the virus was not observed, nor was evidence found for stomatal infection or its transmission by air in spite of abundant opportunity for the virus to get into the air from old infected plants. Under greenhouse conditions excluding accidental infection of roots the virus remained completely localized in inoculated tobacco leaves and does not move to the roots, though these became infected when as little as 0·01 c.c. of the virus was added to the soil. The mode of infection was not determined, but it is suggested that young roots are injured in pushing their way through the soil and the virus may enter through the injured parts, or that the virus may be transmitted by the organisms living in the soil. Cross-immunity tests showed that the tobacco necrosis virus does not belong in the tobacco ring spot No. 1, ring spot No. 2, cucumber mosaic, severe etch, or tobacco mosaic virus groups.

STANLEY (W.M.). **Aucuba mosaic virus protein isolated from diseased, excised Tomato roots grown in vitro.**—*J. biol. Chem.*, cxxvi, 1, pp. 125–131, 1938.

A macromolecular protein was isolated by means of differential centrifugation for 90 minutes at a speed of 24,000 r.p.m. from the juices of aucuba mosaic-diseased tomato roots grown in culture *in vitro*. Its properties [which are discussed in detail] were found to be essentially identical with those of the aucuba mosaic virus protein grown under normal greenhouse conditions [*R.A.M.*, xviii, p. 62]. The concentration reached by the aucuba mosaic virus protein in excised roots *in vitro* was slightly less than that in the roots of greenhouse plants and less than 20 per cent. of that in the foliar tissue of the latter. The isolation of aucuba mosaic virus protein from diseased tomato roots grown *in vitro* demonstrates that the production of virus protein of high molecular weight does not directly depend on the chlorophyll mechanism of a plant, but can proceed in cells supplied exclusively with simple materials of known constitution and structure. The present experiments thus represent an advance in the elimination of certain irrelevant factors tending to obscure the process of virus multiplication as observed in tissues of more complex metabolism.

FERDINANDSEN (C.) & JØRGENSEN (C. A.). **Skovtraeernes Sygdomme. Første Halvdel.** [Forest tree diseases. First half.]—286 pp., 2 col. pl., 124 figs., Copenhagen, Gyldendalske Boghandel, 1938. Kr. 12·50.

The first half of this clearly written, comprehensive treatise on the diseases of forest trees in Denmark is divided into two parts, general and special, the former opening with an outline of fungal development and structure, followed by a survey of the various aspects of infection by parasitic fungi, and the latter (pp. 63–286) comprising descriptions of the various diseases arranged according to the systematic position of the fungi concerned. This very valuable work (the publication of the second half of which is arranged for the spring of 1939) is illustrated by excellent coloured plates and well reproduced photographs.

VERRALL (A. F.). **The longevity of Ceratostomella ulmi in soils.**—*Phytopathology*, xxviii, 10, pp. 763–765, 1938.

After the failure of repeated attempts at the isolation of *Ceratostomella ulmi* from the soil surrounding diseased elm stumps in New Jersey, 7 lots of 10 test-tubes each were partly filled, respectively, with clay loam, clay, sand, swamp muck, hardwood-forest humus, and forest litter, all from the diseased area of the State. Five of the tubes of each soil type were sterilized and all inoculated with *C. ulmi*. Three months later the fungus was isolated from all the sterilized soil samples but not from the non-sterilized ones, with the exception of the forest humus, which gave rise to a sparse growth. After six months *C. ulmi* could still be isolated from the sterilized series, but not from the non-sterilized; all the latter were then reinoculated, but four months later none of them yielded the organism, which survived, however, in 10 out of 35 of the sterilized.

In another test the fungus survived for 120 days in all but one of the sterilized soil samples, but was recovered from only one sample of the unsterilized and this had been stored over calcium chloride.

In a further trial in which humus soil was treated in three ways—sterilized, not sterilized, or sterilized and subsequently re-inoculated with a suspension of its previous organisms—the elm parasite persisted only in the first-named, indicating that its survival is largely dependent on the absence of competing organisms.

The author concludes that even if *C. ulmi* passes into the soil it is unlikely to survive for more than a brief period.

GOIDÀNICH (G.) & AZZAROLI (F.). **Relazione sulle esperienze di selezione di Olmi resistenti alla grafiosi e di inoculazioni artificiali di 'Graphium ulmi' eseguite nel 1337.** [An account of experiments on the selection of Elms resistant to graphiosis and of artificial inoculations with *Graphium ulmi* carried out in 1937.]—*Boll. Staz. Pat. veg. Roma*, N.S., xviii, 2, pp. 149–178, 17 figs., 1938.

This is an expanded account of work already noticed from another source [*R.A.M.*, xvii, p. 636].

SEMPIO (C.). **La cura di Platani fortemente colpiti dalla 'Discula platani' Peck Sacc.** [The cure of Plane trees severely affected by *Discula platani* (Peck) Sacc.]—*Riv. Pat. veg.*, xviii, 9–10, pp. 365–375, 4 figs., 1938.

After referring to the infection of *Platanus occidentalis* trees in Perugia in 1932 by *Discula platani* (*Gnomonia veneta*) [*R.A.M.*, xii, p. 735; xiv, p. 203], the author states that in February, 1933, these trees were subjected to drastic pruning, all the cuts being treated with ferrous sulphate (5 to 6 per cent.) and then tarred. The trunks and branches were next carefully cleaned up and sprayed with Bordeaux mixture (3 to 4 per cent.). During the spring of the same year all the treated trees emitted healthy, vigorous shoots. In the middle of May, all the shoots were removed up to a height of 3 or 4 m. from the ground, the remainder being sprayed with Bordeaux mixture (1 to 2 per cent.). In February, 1934, all undesirable shoots were cut away and this operation was

repeated a year later, when the treated trees were in a highly satisfactory condition.

In 1936 and 1937, fresh and very severe outbreaks of the disease occurred in the same avenue, *P. occidentalis* showing heavy infection, while *P. orientalis* was much more resistant. The outbreaks appear to have been favoured by heavy mists during April in both years. Almost all the trees previously treated recovered, however, and it is concluded that if the pruning treatment is repeated every two or three years the disease will not become endemic, and the trees will continue to make normal growth.

MACDONALD (J. A.). **Fomes fomentarius (Linn.) Gill. [Ungulina fomentaria (Linn.) Pat.] on Birch in Scotland.**—*Trans. bot. Soc. Edinb.*, xxxii, 3, pp. 396–408, 2 pl., 3 figs., 1938.

A study of the fruit bodies of a species of *Fomes* widely present on the trunks and branches of birch trees in the Scottish Highlands showed the species concerned to be *F. fomentarius* [*R.A.M.*, xvi, p. 645; xvii, p. 569, and next abstract]. It differed from *F. igniarius* [ibid., xvii, pp. 358, 763] in the presence of clamp-connexions on the hyphae, its larger spore size, and the absence of setae in the fructification. The colour and character of the spores, and the appearance of the vegetative mycelium differed markedly from those of *F. applanatus* [*Ganoderma applanatum*: ibid., xviii, pp. 2, 4]. Some of the fruit bodies were black and shiny, but as these occurred in close proximity to, or even on the same trunk as, silvery-grey fruit bodies indistinguishable from those found on beech in Canada, it is not regarded as possible to distinguish the two forms of *F. fomentarius* on birch from those on beech or a form *nigrescens* within the types found on birch on the grounds of gross sporophore characters only. When cultures from the dark and light fruit bodies and from infected birch wood were grown in series with isolations of *F. fomentarius* and its var. *nigrescens* from birch and *F. fomentarius* from beech obtained from Ottawa, Baarn, and Princes Risborough there was marked variation in growth rate, rate of colour development, and intensity between the mycelia, but except for variation in luxuriance of growth, no character fell outside the range of those given by C. W. Fritz (*Trans. roy. Soc. Can.*, xvii, p. 191, 1923) for *F. fomentarius*. There were no constant differences between isolations from beech and birch, or between the mycelia of var. *nigrescens* and the typical *F. fomentarius*. All the isolations gave oxidation rings with tannic acid.

The author considers that the reason for the confusion that has existed as to the correct identification of *F. fomentarius*, *F. igniarius*, and *F. nigricans* [ibid., xvi, p. 633] lies in the existence within the species *F. fomentarius* of two superficially distinct types of fruit body marking the extremes of the variations within this species, and occurring at different latitudes. In France, a rapidly growing, soft form occurs on beech. In northern Europe, a more slowly growing, harder, often much darker, type occurs on birch. At the time of his original determination of *F. nigricans*, Fries probably regarded the southern form of *F. fomentarius* as typical of the species, and so gave the new name to the northern European type.

The evidence obtained in these studies proves that distinct varieties

do not occur within the species *F. fomentarius*. The names *F. nigricans* and *F. fomentarius* var. *nigrescens* should therefore be regarded only as synonyms of *F. fomentarius*.

BJØRNEKÆR (K.). **Undersøgelser over nogle danske Poresvampes Biologi med særligt Hensyn til deres Sporefældning.** [Studies on the biology of some Danish Polyporaceae with special reference to their spore discharge.]—*Friesia*, ii, 1, pp. 1–41, 11 figs., 1938. [English summary.]

A comprehensive account is given of the author's studies on the duration of the spore discharge period of some Polyporaceae of common occurrence in Denmark, namely, *Daedalea gibbosa*, *D. quercina* [*R.A.M.*, xvi, pp. 4, 425], *Polyporus adustus* [ibid., xvii, p. 196], *P.* [*Fomes*] *annosus*, *P. applanatus* [*Ganoderma applanatum*], *P. cupreolaccatus* Kalchbr., *P.* [*F.*] *fomentarius* [see preceding abstract], *P. fuliginosus* (Scop.) Fr. [*P. benzoinus* (Wahlenb.) Fr.: ibid., xvi, p. 4], and *P. odoratus* [*Trametes odorata*: ibid., xiv, p. 795]. The spores were collected on a piece of paper enclosed in a capsule and brought into close contact with the hymenial surface of the fruit bodies by a simple contrivance [which is explained].

The nine species under observation fell into four groups in respect of the length of their spore discharge periods, viz., (1) the summer half-year (April to October), comprising *D. quercina*, *G. applanatum*, *P. cupreolaccatus*, and *F. fomentarius*, discharge in the last-named having two distinct peaks, vernal and autumnal, and coming to a partial or total standstill during the heat of summer; (2) the winter half-year (October to March), represented by *P. benzoinus* and probably *P. adustus*; (3) the whole year except February and March (*D. gibbosa* and *T. odorata*); and (4) continuous unless arrested by severe frosts (*F. annosus*).

The spring spores of *F. fomentarius* are considerably larger than those discharged in the autumn (average length 21 as compared with 15 μ), and a similar relationship probably holds good for other Polyporaceae. *F. fomentarius* has been shown by calculations of the annual growth-rate to produce at least two tube-layers, corresponding to the above-mentioned vernal and autumnal peaks of spore discharge. There is considered to be no reliable foundation for reports of the discovery of specimens of *F. fomentarius* more than ten years old. New hosts of the fungus in Denmark are sycamore (*Acer pseudoplatanus*) and alder (*Alnus glutinosa*).

LOHWAG (K.). **Ganoderma resinaceum Boud., Erreger einer charakteristischen Fäule.** [*Ganoderma resinaceum* Boud., the agent of a characteristic decay.]—*Zbl. ges. Forstw.*, lxiv, 10, pp. 258–260, 2 figs., 1938.

In the autumn of 1937 the writer detected fruit bodies of *Ganoderma resinaceum* on externally healthy Turkey oaks [*Quercus cerris*: *R.A.M.*, xvi, p. 4] growing near the rotten stumps of felled oaks in the Lainz Zoological Garden, Vienna. In the following spring a 200-year-old oak was felled and found to be extensively permeated by the same fungus, which proceeded from the base upwards and at a height of 6 in. merged into the brownish-black discoloration caused by *Phellinus* [*Polyporus*]

dryadeus [loc. cit.], a limiting layer separating the portions of the trunk occupied by the two organisms. A remarkable feature of the rot due to *G. resinaceum* is the preservation of the medullary rays long after the intervening tissues are disintegrated and consumed by ants or washed away by rain.

CHILDS (T. W.) & KIMMEY (J. W.). **Studies on probable damage by blister rust in some representative stands of young western White Pine.**—*J. agric. Res.*, lvii, 8, pp. 557–568, 3 graphs, 1938.

The studies outlined in this paper were made to determine the relationship between intensity of infection of the western white pine (*Pinus monticola*) by blister rust (*Cronartium ribicola*) [*R.A.M.*, xvii, p. 572; xviii, p. 73] and degree of damage to the trees, as affected by some of the more important environmental and other factors, and were generally carried out in areas in British Columbia and Idaho where practically all the cankers had originated in a single year or in two consecutive years as indicated by Lachmund's method [ibid., xii, p. 603]. The probable effect on the tree of each canker was calculated on the basis of previous studies by Lachmund on the behaviour of the rust on pines [ibid., xiii, p. 605]. The results indicated that the percentage of cankers capable of causing damage ranged from nearly 100 in the smallest trees to less than 30 in trees from 45 to 50 ft. high, but that the larger trees (up to at least 40 ft.) are much more heavily infected than the smaller, and are therefore more liable to suffer damage. Both the percentage of potentially injurious cankers and the length of time required for the damage to occur may vary within a given height class, according to the width of the crown, the rate at which branches are killed by suppression, and other factors. The investigations are considered to have shown that serious damage to western white pine stands may result from relatively few cankers, and that if these stands are exposed to even moderately severe infection they will be practically destroyed before reaching commercial maturity.

PIERSON (R. K.) & BUCHANAN (T. S.). **Susceptibility of needles of different ages on Pinus monticola seedlings to Cronartium ribicola infection.**—*Phytopathology*, xxviii, 11, pp. 833–839, 1938.

From 7th September to 11th October, 1933, at Deep Creek, Idaho, 34 potted native *Pinus monticola* seedlings, ranging from 5 to 7 years of age and from 7 to 15 in. in height, were exposed to infection by *Cronartium ribicola* [see above, p. 149] from the highly susceptible *Ribes petiolare* [*R.A.M.*, xvii, p. 143], dense bushes of which were growing in such a way as to form an almost closed leafy canopy over the trenches occupied by the pines. After a minimum incubation period of 66 days the incidence of the resultant needle spots was computed in relation to the age of the infected material. The current season's needles were found to be comparatively resistant (the average number of spots per 100 sq. cm. surface area being 1·3) [cf. ibid., xvi, p. 287], those of the second and third years relatively high and approximately equal in susceptibility (18·9 and 18·8), while the few fourth-season needles represented were intermediate in their reaction, but with a tendency to susceptibility (12·4).

Wright (E.). **Further investigations of brown-staining fungi associated with engraver beetles (Scolytus) in White Fir.**—*J. agric. Res.*, lvii, 10, pp. 759–773, 4 figs., 2 graphs, 1938.

In continuation of his studies on the brown stain in white fir (*Abies concolor*) caused by *Trichosporium symbioticum* [*R.A.M.*, xiv, p. 666], and associated with egg galleries of *Scolytus ventralis*, a somewhat similar but lighter brown stain in the same host was observed in connexion with the egg galleries of *S. praeceps* and *S. subscaber*. The egg galleries of all these beetles are confined to the cambial region, but those of *S. ventralis* are found at the base of the trees, those of *S. praeceps* at the top, and those of *S. subscaber* in the branches. Isolations from the stained bark and adjacent sapwood and from newly emerged beetles indicated that the stain associated with *S. praeceps* and *S. subscaber* is caused by a fungus identified as *Spicaria anomala*, while *T. symbioticum* was again observed to be constantly associated with *Scolytus ventralis*. In ten different trees inoculated with cultures of both fungi the average visual longitudinal spread of *Spicaria* stain was found to be 3·5 mm. per week, that is about one-half as fast as the spread of the *Trichosporium* stain in the same tree. It was also observed that *S. anomala* killed the cambium, thus apparently helping the beetle to invade the trees. The reaction of the two fungi to physiological conditions did not show significant differences. Wood stained by *T. symbioticum* was found to contain only three-fifths, and that stained by *S. anomala* less than one-half, as much moisture as that present in unstained wood of the same tree. It is conjectured that each fungus may serve to maintain a moisture balance favourable for the broods of their respective beetle associates.

Jump (J. A.). **A study of forking in Red Pine.**—*Phytopathology*, xxviii, 11, pp. 798–811, 3 figs., 1 graph, 1938.

Pursuing his studies on the abnormal bifurcations of red pine (*Pinus resinosa*) in New York State and other parts of the north-eastern United States, the writer presents further information on the disorder supplementary to that already noticed from another source [*R.A.M.*, xvii, p. 494]. Among the organisms isolated from diseased trees was a species of *Tympanis*, which appeared from comparative cultural studies to be identical with Hansbrough's material of *T. pinastri*, causing canker of the same host [ibid., xvi, p. 289]; in the majority of cases the fungus presumably enters the tree through fissures resulting from forking. *Dematium* [*Pullularia*] *pullulans*, however, was the organism most consistently isolated from various parts of infected trees, including the lateral and terminal buds, pith and discoloured surrounding wood, and discoloured wood of the root crown. In inoculation experiments on young trees with conidial suspensions of the fungus, reisolations were effected after five weeks from the stem at distances of 1 to 2 cm. from the site of infection.

By means of Granick and Dunham's technique (consisting essentially in the measurement, after four days' exposure to light, of the longitudinal growth increments in the upper centimetre of a 7 to 8 cm. etiolated, decapitated lupin hypocotyl, to the cut surface of which the test substance is applied in lanoline paste or agar), *P. pullulans* was found

to contain a growth-promoting substance in quantities exceeding those present in the other organisms investigated, viz., Fleischmann's yeast, *Fusarium* sp., *T. pinastri*, and *Polyporus schweinitzii*. On this basis it may be supposed that abnormal growth of a pine bud can be initiated through the action of a phytohormone produced by the fungus living within the tissues.

No definite correlation could be established between the incidence of forking and environmental conditions, though the fact that the lowest percentage of diseased trees occurred at high altitudes in the northern part of the area inspected suggests the implication of temperature and latitude as limiting factors in the development of the disturbance.

CAMPBELL (A. H.) & VINES (A. E.). **The effect of Lophodermellina macrospora (Hartig) Tehon on leaf-abscission in Picea excelsa Link.**—*New Phytol.*, xxxvii, 4, pp. 358–368, 2 pl., 1 fig., 1 graph, 1938.

In discussing the factors preventing needle fall in the α form of the disease produced on *Picea excelsa* [*P. abies*] by *Lophodermellina macrospora* [syn. *Lophodermium macrosporum*: *R.A.M.*, xvii, p. 421], the authors describe the mechanism of abscission in the normal needle as follows. The needle is borne on a peg-like cushion, above which is a clear hyaline layer encircling the base of the needle. Between the cushion and hyaline layer is a layer, not exceeding two cells in width, composed of small, irregular, thick-walled cells, called tooth cells, which become red on staining with Sudan III, indicating the presence of cutin-like material. The hyaline layer consists of much larger cells of the stone cell type with small lumina and very thick lignified walls. The cells are elongated parallel to the longitudinal axis of the needle, the contraction of the walls thus taking place at right angles to the needle axis. The hyaline layer is regarded by the authors as a part of the hypodermis and the tooth cells a modified continuation of the epidermis, the entire needle being thus enclosed in a sheath of sclerenchyma except at the entrance of the vascular track.

From the experiments with both living and dead twigs it appeared that the abscission of the needles under drying conditions depended upon the hygroscopic contraction and the resulting separation of the hyaline layer from the tissues of the cushion following water loss from the needle. The exact amount of water lost from the needle is not, however, the decisive factor, but rather the difference in loss of water between the hyaline layer and the cushion, the fall of the needles occurring when the water loss from the needle is considerably in excess of that from the cushion. A brown substance suggesting wound gum was found filling the vascular track in the cushions from which needles had fallen recently, but was absent in the cushions of living needles. It is believed to bring about normal needle fall by stopping the water-supply to the needle and thus inducing the abscission mechanism to function.

The material used in this study was collected from a 30 years' old plantation of *P. abies* at Ballindalloch, Banff, Scotland. The needles affected with the α form of the disease showed a black ring round the base, and occasionally one or more close to the tip, whereas in those affected with the β form (in which the needles fall) these rings were absent. In a longitudinal section through the needle base the black

rings were seen to cover the whole region of the hyaline layer, the chief cause of the blackening being a dark brown pigment produced by the dark brown hyphae, 3 μ in diameter, observed in the lumina of the cells; these hyphae aggregated into a thin, pseudoparenchymatous partition, about 20 μ thick, across the needle, becoming much more substantial in the vascular bundle. All stomata of the whole needle were found to be completely blocked by black, pseudocollenchymatous plugs, the substomatal sclerotia. The retention of needles is explained by the greatly reduced rate of water loss from the needle, brought about by the blocking of the stomata by the substomatal sclerotia and the presence of the mycelial plugs at the base and sometimes near the tip of the needle, by which means the needle is converted into a kind of sclerotium.

Růžička (J.). **Doklad o škodlivosti nesprávného původu Smrkového semene.** [Proof of the harmfulness of using Spruce seed from inappropriate sources.]—*Lesn. Práce*, xvii, 10, pp. 533–539, 1 fig., 1938. [German summary.]

The author reports that a stand of Norway spruce [*Picea abies*] of 20 hect., planted before 1906 on different types of soils at an altitude of 715 m. above sea-level near Pacov in southern Bohemia, became stunted and was partly destroyed by *Ascochyta piniperda* [*R.A.M.*, xvii, p. 567], while adjacent stands, planted after 1906 grew well. The spruce seed used before 1906 was obtained from Viennese and Tyrolese firms, and was most probably of Alpine origin, whereas after 1906 the seed was usually bought from Czech firms, and mostly originated in the comparatively low Šumava mountains. It is concluded that the spruce stands planted from Alpine seeds become stunted and readily succumb to attacks of *A. piniperda*.

It is intended, after clearing the present stand, to replant it with other conifers, since Norway spruce, even of suitable origin, is too liable to contract infection in this heavily infested district.

Garren (K. H.). **Studies on Polyporus abietinus. I. The enzyme-producing ability of the fungus.**—*Phytopathology*, xxviii, 11, pp. 839–845, 1938.

The coniferous sapwood-destroying fungus *Polyporus* [*Polystictus*] *abietinus* [*R.A.M.*, xvii, p. 196] was shown by *in vitro* and *in vivo* tests to form 15 of the more common hydrolytic enzymes, viz., emulsin, cellulase, ligninase, amylase, sucrase, maltase, inulase, pectinase, tanninase, pepsin, trypsin, erepsin, urease, asparaginase, and lipase, and four belonging to the oxidizing group, namely, oxygenase, peroxidase, laccase, and catalase.

A comparison of *P. abietinus* with the records of 17 well-known wood-destroying fungi in respect of enzyme production reveals a more copious output by the former than by any of the others tested except *Lenzites sepiaria*.

The variety of hydrolytic enzymes secreted by *P. abietinus* suggests that the materials (including glucosides, sucrose, and proteins) stored in the wood parenchyma are of considerable importance in the nutrition of the organism.

The *in vitro* method of testing (involving culture on autoclaved loblolly pine [*Pinus taeda*] sawdust and extraction of the enzyme) was found to afford more accurate information than the *in vivo* tests (on cultures grown on synthetic media plus a suitable substance, e.g., urea for urease) as to the total number of enzymes produced by a given fungus.

Palén (A. G. P.). **Arseniken och dess användning för träkonservering och växtskyddsmedel.** [Arsenic and its utilization as a wood preservative and plant protective.]—*Tekn. Tidskr.*, lxviii, 32, pp. 375–378, 2 figs., 1 graph, 1938.

Further particulars are given of the writer's experiments at a Swedish mining concern on the practical application of his newly developed method of coniferous wood preservation by means of metal arsenates [*R.A.M.*, xv, p. 623]. The following percentages in relation to the dry wood substance were the safety limits for the effective control of *Coniophora cerebella* [*C. puteana*], *Merulius lacrymans*, and *Lentinus squamosus*, respectively, in tests on impregnated wood blocks [loc. cit.] with the arsenic compounds and three standard preservatives: calcium arsenate 0·033 to 0·08, 0·08 to 0·16, and 0·08 to 0·42; barium arsenate (*C. puteana* and *M. lacrymans*) 0·015 to 0·036 and 0·047 to 0·07, respectively; magnesium arsenate (*C. puteana*) 0·042 to 0·097; chromium arsenate (*C. puteana* and *M. lacrymans*) 0·025 and 0·16, respectively; zinc arsenate 0·034 to 0·04, 0·07, and 0·077 to 0·15, respectively; manganese arsenate (*C. puteana* and *M. lacrymans*) 0·04 and 0·014 to 0·031, respectively; copper arsenate (*C. puteana*) 0·03; zinc chloride 0·6 to 1·6, 0·6 to 1·54, and 0·7, respectively; zinc-meta-arsenite (*C. puteana* and *M. lacrymans*) 0·035 and 0·04 to 0·08; and creosote (*C. puteana* and *L. squamosus*) 1·3 to 6·8 and 10 to 12·7, respectively.

Of the various modes of application tested, the most practical was found to consist in the introduction into the wood of ortho-arsenic acid combined with the several arsenates in such a way as to produce insoluble arsenate in the wood on reaction with its constituents, impregnation being carried out under pressure. The treatment is stated to involve no risks due to the poisonous character of the compounds and to compare favourably with creosote from the standpoint of economy.

Brecht (W.), Schröter (H.), & Süttinger (R.). **Holzschliff aus angeblautem Kiefernholz.** [Wood pulp from blued Pine wood.]—*Papierfabrikant*, xxxvi, 41, pp. 423–425, 1 graph, 1938.

A tabulated account is given of experiments at the Darmstadt (Germany) Technical College to determine the effect of blue stain (*Ceratostomella* spp.) on the pulp obtained from severely diseased 50- to 55-year-old pine wood in comparison with the product of similar healthy material. The defect was found to cause no perceptible loss of strength [cf. *R.A.M.*, xv, p. 185], nor were the sheets of paper prepared from the stained pulp lacking in resistance to stress as compared with those from the controls—rather the reverse, in fact. The sole drawback to the utilization of stained pulp lies in the dull greyish-blue coloration, which it may be possible to counteract by a special bleaching process.

FINDLAY (W. P. K.). **The natural resistance to decay of some Empire timbers.**—*Emp. For. J.*, xvii, 2, pp. 249–259, 1 pl., 1938.

A full account is given of tests carried out at Princes Risborough to determine the resistance to fungal decay of all species of timber received from different parts of the British Empire. In the laboratory tests, small pieces of wood, 10 by 2·5 by 1·25 cm., are cut and planed with the long axis parallel to the grain, heated for 18 hours at 100° C., weighed aseptically, and immediately placed on actively growing cultures of the test fungi on 2 per cent. malt agar medium in special culture flasks. Ten samples are tested against each species of fungus, two samples being inserted into each flask. The flasks are maintained at 22°, sterilized water being added as required to a reservoir in the neck. After four to eight months, the blocks are removed and their final dry weight and moisture content determined. The loss of dry weight due to infection is then calculated as a percentage of the original dry weight. The fungi used included *Merulius lacrymans*, *Coniophora cerebella* [*C. puteana*], *Polystictus versicolor*, *Lenzites trabea*, *L. sepiaria*, *P. sanguineus*, *Poria vaillantii* [*R.A.M.*, xviii, p. 76], and *Lentinus lepideus*. The results obtained in recent tests on 52 timbers are tabulated in full, the species very resistant to decay including *Baikiaea plurijuga*, *Chlorophora excelsa*, *Dryobalanops aromatica*, *Ocotea usambarensis*, *Peltogyne porphyrocardia*, and seven others. Field tests, in which small stakes were driven into the ground to a depth of 12 in., are in progress, and preliminary observations indicate that they will confirm the laboratory experiments.

The durability of the heartwood of most timbers is due mainly to the presence of certain extractives, soluble in water, alcohol, or benzol, which are formed as the sapwood is changing into heartwood, and are toxic to wood-destroying fungi.

No direct relationship exists between the specific gravity and durability of timbers, though most very heavy timbers tend to be durable, and most light ones are susceptible to fungal decay. Within any one species it is probable that the higher the density the more durable the timber. As a general rule, dark timbers are more resistant than light ones.

LOHWAG (H.). **Mykologische Studien—XIV. Zur Anatomie des Strangmyzels von Gyrophana lacrymans (Wulf.) Pat.** [Mycological studies—XIV. On the anatomy of the strand mycelium of *Gyrophana lacrymans* (Wulf.) Pat.].—*Ann. mycol., Berl.*, xxxvi, 5–6, pp. 401–434, 6 figs., 1938.

The author gives a revised description of the mycelial strands of *Gyrophana* [*Merulius*] *lacrymans* [*R.A.M.*, xvii, pp. 282, 641, 785], based on the studies by Falck (Die Merulius Fäule des Bauholzes. 1912), but incorporating new observations. The fungus is stated to possess a tufted mycelium with hyphae characterized by tendril-like side branches, which become intertwined and thus form strands. These strands consist of several types of hyphae: the fibrous hyphae have thick walls, measure 4 to 5 μ in diameter, are non-septate, and form a well-defined fibrous cortex; the vessel (or sap) hyphae have no septa or clamp-connexions, but form metasepta and irregular thickenings in the walls, and are sometimes lobed in cross-section; the tube hyphae become thinner

at both their ends and are filled with albumin in the form of crystals or as an amorphous mass; and the structural threads are septate hyphae with clamp-connexions and thin walls, and are filled with protoplasm. The last-named are capable of giving rise to the other types of hyphae.

The growth of the strands is very rapid, amounting at optimal temperatures of 18° to 22° C. to 1 cm. in two days. The strands serve the fungus as channels for transporting nutritive substances, but they can sometimes form temporary sclerotia. Falck distinguished such compound mycelial strands in the Basidiomycetes from true rhizomorphs under the name of syrrotia, basing this distinction on certain developmental and morphological characters, namely, that rhizomorphs did not originate by the intertwining of hyphae but were from the first individual structures with terminal growth, and also that they possessed no vessel or fibrous hyphae and were hollow in the middle. The author discusses these points at length, drawing examples from many sources, and comes to the conclusion that they are not supported by a closer examination of the evidence and that mycelial strands having the structure described above can be included in the term rhizomorph.

PARRIS (G. K.). **The diseases of truck crops in Hawaii.**—*Ext. Bull. Hawaii agric. Exp. Sta.* 33, 78 pp., 42 figs., 1938.

In this popular booklet on the diseases of vegetables in Hawaii the outstanding symptoms, etiology, and the most recent methods of control of the various diseases are discussed and their economic importance indicated.

ARRUDA (S. C.). **A podridão parda da Couve Flor.** [Grey rot of Cauliflower.]—*Biologico*, iv, 10, pp. 343–344, 1 fig., 1938.

Attention is briefly drawn in popular terms to the occurrence in Campinas, Brazil, of a grey rot of cauliflower heads due to *Alternaria brassicae* [*R.A.M.*, xvii, p. 284], the direct control of which presents considerable difficulty owing to the risk of depreciation of the marketable product by fungicidal sprays. Treatment of plants destined for seed production with 1 per cent. Bordeaux mixture is admissible, but in general the most reliable means of combating the disease consists in protracted crop rotation (four to five years).

GIBBS (J. G.). **A technique for studying the longevity of Phoma lingam in the soil.**—*Phytopathology*, xxviii, 10, pp. 762–763, 1 fig., 1938.

At the Plant Research Bureau, New Zealand Department of Scientific and Industrial Research, Palmerston North, roots of Superlative swedes were topped, washed, incised with a sterile scalpel, and immersed in groups of four in one of a graded series of aqueous spore suspensions of *Phoma lingam* [*R.A.M.*, xiv, p. 54; cf. also ibid., xvii, p. 297] containing from one spore per 10 c.c. to 100,000 per 1 c.c. Typical dry rot lesions developed on swedes steeped in suspensions with 5 spores per c.c. and upwards, the maximum incidence of infection (100 per cent.) being secured at a concentration of 100,000 per c.c. In this series the fructifications of the fungus appeared on the roots within 12 days instead of the normal period of six weeks and two months required when inoculations are made from agar cultures on swedes and potato dextrose agar,

respectively, at 21° C. In soil tests aqueous suspensions were made with soil collected within 1 ft. of infected swedes and also from the same sites two months after removal of the roots. Heavy infection by *P. lingam* occurred in both series of suspensions. The new technique facilitates the study of the longevity of the dry rot fungus in the soil, which was formerly complicated by the liability to extensive contamination in dilution plates and the slow growth of the organism in culture.

TOMPKINS (C. M.). **A mosaic disease of Turnip.**—*J. agric. Res.*, lvii, 8, pp. 589–602, 4 figs., 1938.

An account is given of the author's comparative studies carried out in greenhouses in Berkeley, California, of the turnip mosaic [*R.A.M.*, xvii, p. 574] prevalent on Long Island, New York, with virus diseases of cruciferous crops in California. The disease was transferred by mechanical inoculation to healthy Purple Top White Globe turnip seedlings and the symptoms produced by this virus are stated to have remained unchanged through successive monthly transfers since 1934, when the investigation was started. On seedlings of the above-named turnip variety the initial symptoms consist of a conspicuous, coarse, systemic clearing of the veins, with interveinal mottling; the leaves show marked crinkling and slight dwarfing; and the plants are stunted in the early stages of infection. As the leaves expand, the coarse yellowing is superseded by a preponderance of very dark green, irregular, raised islands, interspersed with a restricted amount of chlorotic tissue. Crinkling of the leaves is accentuated and subsequently the dark green islands are almost entirely replaced by chlorotic, light green areas. No lethal effect of the infection was observed on this or any other susceptible host. Under greenhouse conditions the turnip mosaic was readily transmitted by *Myzus persicae* and *Brevicoryne brassicae*, or by mechanical inoculation using carborundum as an abrasive; the incubation period ranged from 13 to 21 days. The virus was inactivated after ageing for three days *in vitro* at 22° C. Its inactivation temperature (10 minutes' exposure) is between 60° and 63°, and its tolerance to dilution is 1 in 3,000. The host range of the virus, as far as established, includes 18 species of plants representing 12 genera in 6 families; 11 of the species belong to the Cruciferae and include, among others, cabbage, cauliflower, rutabaga, Chinese cabbage (*Brassica pe-tsai*), annual stock (*Matthiola incana* var. *annua*), and Chinese radish. From a careful review of the literature dealing with the viruses of turnip and rutabaga, the author believes that the question of the identity of the viruses described cannot be solved on the basis of the information available so far, and that any definite conclusion would not be justified.

FOX (D. E.). **Occurrence of the Beet leafhopper and associated insects on secondary plant successions in southern Idaho.**—*Tech. Bull. U.S. Dep. Agric.* 607, 43 pp., 4 graphs, 1938.

Studies carried out from 1928 to 1933 on the successions of plant cover on newly abandoned lands in southern Idaho and on the general breeding area of the beet leafhopper (*Eutettix tenellus*), which is of great economic importance as the vector of curly top of beets, tomatoes, and other cultivated crops [*R.A.M.*, xviii, p. 78 and next abstract]

demonstrated the significant part played by annual weeds in the production of large populations of this and other injurious insects. *E. tenellus* was found to be mainly supported by Russian thistle (*Salsola pestifer*), flixweed (*Sophia parviflora*), and tumblemustard (*Norta altissima*), but was also able to make use of sagebrush (*Artemisia tridentata*) as a temporary or 'hold-over' host during the autumn and other periods when more congenial hosts are unavailable.

MURAYAMA (D.). **Physico-chemical properties of the virus of Broad Bean mosaic.**—*J. Fac. Agric. Hokkaido Univ.*, xliv, 1, pp. 1–32, 1 pl., 1938.

A fully tabulated account is given of studies on the physico-chemical properties of the broad bean mosaic virus [*R.A.M.*, xvii, p. 645] carried out from 1935 to 1937 at the Morioka Imperial College of Agriculture and Forestry and the Hokkaido Imperial University, Japan. The virus lost its infectivity (gauged by needle-prick inoculation experiments on young broad beans of the Issun-Soramame variety) at dilutions exceeding 1 in 1,000, while ten minutes' heating at 63° C. also resulted in a substantial diminution or total inactivation of the infective capacity of the juice. The virus was destroyed by 21 to 25 days' ageing *in vitro* at room-temperature or 15 to 20 days in the incubator at 25° to 28° C.; the addition of a drop of toluol to the juice not only failed to maintain it in a virulent condition but actually accelerated the loss of infectivity, which took place after 8 days. Rapid inactivation of the virus further occurred in diluted plant extract. The infective principle withstood 20 to 25 and 25 days' desiccation in the plant tissues during the summer and winter, respectively. The virus succumbed to half-an-hour's exposure to 1 per cent. formaldehyde and, except in one instance, to 50 per cent. alcohol. The infectivity of the broad bean mosaic virus was at its height at P_H 4 to 8 and rapidly declined when the alkalinity or acidity of the suspension was increased to P_H 9 or 3, respectively. The virus failed to traverse the coarse porcelain filters, Shofer L1 and L2. The Japanese broad bean mosaic virus appears to approximate to Osborn's pea virus 2 [ibid., xvii, p. 249] or Pierce's pea virus 3 [ibid., xvii, p. 90] in its thermal death point, but its longevity *in vitro* considerably exceeds that of the American viruses.

Amtliche Pflanzenschutzbestimmungen. [Official plant protection regulations.]—*Beil. NachrBl. dtsch. PflSchDienst*, x, 7, pp. 208–213, 1938.

LATVIA. Particulars are given of regulations issued on 30th April, 1938, concerning the organization of the Latvian Plant Protection Service; commerce in, and supervision of, plant protectives and automatic spraying or dusting apparatus; inspection of tree nurseries; and control of the import, export, and transport of plants and parts thereof, in which connexion provision is made for the accompaniment of imported potato consignments by certificates vouching for the absence of wart disease (*Synchytrium endobioticum*) from the place of cultivation during the previous ten years [cf. *R.A.M.*, xvi, p. 848].

[Details of regulations published on 30th June, 1938, governing the sale of plant protectives in Latvia are given in *Int. Bull. Pl. Prot.*, xii, 11, pp. 246M–247M, 1938.]